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Commission Control of Power Supply

ESTABLISHING a priority list for power consumers was the onerous task that suddenly loomed before the California Railroad Commission. Even under the most favorable conditions the arbitrary announcement of who might and who might not buy power would be sure to develop opposition and probably litigation. Fortunately a better plan has been developed, and although some California industries may later suffer curtailment, they will first have an opportunity to co-operate in the reduction of waste, and in the event that further restriction becomes necessary will still have the right to a final hearing before the Power Administrator. If arbitrary action had been taken, there would remain to be settled the question of whether a priority list could be legally enforced when opposed on the grounds of confiscation. Should litigation be instituted by consumers, it will be handled by the commission and not by the power companies. However, litigation is unlikely under the plan of transferring power conservation problems to a separate bureau under the direction of an administrator. The plan has the advantage of enlisting the interest and co-operation of all affected parties and establishes a precedent for action by state utility commissions in line with the policy being followed by federal bureaus.

Our Marines the Devil Hounds

WITH this issue each reader will receive a copy of a war poster, "Our Marines." Newspaper dispatches recounting the exploits of these men in France say they fought so tenaciously and to such good effect that the enemy nicknamed them "the devil hounds." This, of course, is very gratifying to us at home; but if these men are to persist and conquer, we here must do our part, not only in keeping them supplied with war materials, but in hounding the devil at home no matter in what shape he appears. Otherwise our sacrifices may be to no avail. The world-German war has resolved itself into an economical and technical strife. Not that our ideals are one whit less righteous, but that technical experience and professional skill are now as important as military perfection. Of every man possessing a technical education a peculiar service is expected. First, the government needs engineers in various branches of the service both at home and abroad. Then it expects that those great economies which only skilled engineers can produce will be forthcoming in this country and that engineering thought will be concentrated on the problems with which we are confronted abroad. Efficiency is as much a requisite to our national life as it is to our national salvation, and the greatest proponents of efficiency are our engineers.

Respond Promptly with Facts on Rates

TWO points bearing on the public utility situation stand out clearly in the discussion and negotiations of the times. One is that the utilities are not entirely self-governing and they cannot, therefore, solve their problems by their own independent action; they must have sympathetic co-operation from the outside. The other is that if no authority will take the definite responsibility of helping the utilities, if every constituted authority is to go on the mistaken theory that while the thing ought to be done, some one else ought to do it, the utilities are in a sad plight of orphanage.

Legally the authority and the responsibility rest largely, if not entirely, upon the state or municipal officials who are the regularly constituted supervisory powers in public utility matters. But it is very far from a purely legal issue, for the condition of war gives the federal government usurping powers which it is using in its best judgment to carry on to victory. In the federal government program a new standard of importance is set up, and questions become of major or minor rank according as they have to do definitely with winning the war or with matters of, for the time being, less consequence. We must as one nation work all elements co-operatively. It is necessary for the federal government to segregate these questions in every detail of its program, and no one would have it otherwise. It is equally desirable that state and municipal authorities should concur in the national program. The utilities constitute at this time an issue which positively touches the war program, and they are in real need of consideration as vital elements in the conflict.

President Wilson turned aside from his other heavy burdens of care to say: "It is essential that these utilities should be maintained at their maximum efficiency and that everything reasonably possible should be done with that end in view." We urge any lukewarm individuals to observe closely that the President, a master of English, said "essential." Not "desirable," not "important," not a mere matter of routine to be attended to if there was no other business pending, but *essential*. And he said "maximum efficiency"; he is satisfied that simply to run the plant in any old way

would not whip the enemy. And the other striking phrase of President Wilson's letter to Secretary McAdoo is just as impressive: "I hope that state and local authorities, where they have not already done so, will, when the facts are properly laid before them, respond promptly to the necessities of the situation." This puts the obligation, so far as the President can do it, squarely up to the utilities to lay the facts before the constituted rate-regulating authorities. And he would have the authorities respond, not after a delay of two or three years shall have let the emergency grow cold, not when the patient is ready to inter, but *promptly.*

With the moral support of the President, Secretary of the Treasury McAdoo and Comptroller of the Currency Williams, the state commissions and local authorities have not the shadow of an excuse for inaction. They know that electric rates have gone down for years; they know that costs have gone skyward under war conditions; they know that the result is one which no prudent business man or householder would regard calmly in his own affairs. It is right up to the rate-regulating authorities to do their part in keeping these invaluable public servants at the high mark of efficiency.

We declare that in the main the electric utilities which need help have laid or will lay the facts "properly" before the authorities. Their managers know full well that they are more than a cog in the war machine; they are a prime driving power in that machine. They are not asking that things which are not so shall be taken as facts; they ask only that the high costs which are as prominent as the nose on a man's face shall be recognized as elements in rates.

A Suggestion for Fuel Economy

THE necessity of the utmost economy in the use of fuel is gradually being brought home to all operators. Through all of the discussion before the convention of the N. E. L. A. last week that thought was constantly recurring.

Exactly in line with various recent discussions of fuel economy was the description by L. A. Stenger in the ELECTRICAL WORLD of May 25 of experiments on the combustion of coals carrying large quantities of dust. Everybody is getting at present about such coal as is available, and no one can longer count on selected high-grade fuel of uniform size. Mr. Stenger's experiments were directed chiefly to the air flow through fuel beds composed, on the one hand, of clean coal and, on the other, of coal carrying much dust, meaning by dust particles up to ⅛ in. (3.2 mm.) in diameter. Although the general effect of dust in choking air supply is familiar, the extent to which it may do this and the disastrous effect on efficiency, as disclosed by Mr. Stenger's figures, are somewhat surprising. The immediate effect of dust, particularly if it settles in layers and is not uniformly disseminated, is to choke the passage of air so much that the combustion in ordinary furnaces is very unsatisfactory. Wetting the coal aggregates the dust in lumps or attaches it to the larger pieces of coal so that the particles no longer pack and obstruct the air. Even after drying so much of the dust sticks together and to the rest of the coal that the aggregate burns more freely than before wetting.

The most striking effect brought out was the degree to which dust injures the fuel efficiency. One of the experiments showed that a dust-free coal of only 9900 B.t.u. gave much better results than a dusty coal of 12,000 B.t.u. Of course, in suitably designed furnaces one can burn almost any kind of fuel with fair economy, but in attempting to fire dust-bearing coal in ordinary furnaces there is certain to be considerable loss. Even under very favorable circumstances the dust is still an embarrassment in obtaining efficient combustion. Poor combustion means not only lowered efficiency but lower boiler capacity. Mr. Stenger's suggested remedy for dealing with this troublesome matter is simple and in plants of considerable size ought to work out very well. It is merely to crush the coal as received to a uniform rather small size and then to screen out thoroughly the dust. The crushed coal would then be used in the ordinary furnaces, while the dust would be pulverized and fed to boilers equipped with suitable combustion chambers as indicated recently in these columns. In this way the dust instead of obstructing the combustion of the normal coal would itself be burned at an efficiency quite up to all that its B.t.u. value should imply.

Building a Mountain Transmission Line

THE topography of our western coast country is a constant stimulus to the constructing engineer. He there has to meet conditions of very various and troublesome character within a comparatively short space, and he has generally succeeded admirably in rising to the situation. A thoroughly typical case of the unusual things that have to be done in the Pacific Coast transmission systems is described in our current issue. The great solar observatory on Mount Wilson needed power in excess of the modest amount which could be furnished from its original oil-engine-driven plant. The peak is somewhat more than a mile high. Oil as well as all the other supplies had to be hauled to the top, and in winter the road is sometimes impassable. Therefore it became necessary to tap a power circuit, and the nearest available one, belonging to the Southern California Edison Company, was a 15,000-volt circuit about seven miles (11.2 km.) away in an air line, most of the distance being over mountain tops and wild canyons. So over peaks and canyons the line was carried, and because of the contour of the country the larger part of it was strung in spans averaging more than 2000 ft. (914 m.), sweeping over canyons and carried at sharp pitches up the mountain side.

As the amount of power to be transmitted was not large, the line conductors are of 5/16-in. (7.9-mm.) seven-stranded steel cable. The weight of the up-hill long spans being too severe for ordinary insulators, the line was carried on three regular strain insulators in series, which gave an ample factor of safety both in mechanical strength and in insulating power. As a still further efficient innovation, these long and difficult spans are supported at the ends by three 40-ft. (12.19-m.) wooden poles in tandem, heavily guyed. The trail was so crooked that these had to be transported with the tops well pitched into the air on a trestle carried by the truck, otherwise they could not have

made the curves. Our illustrations give a vivid idea of the efficient resourcefulness of the engineers of the Southern California Edison Company, who built the line. The power transmitted is received at a substation at the observatory, where it is converted into direct current for use in the delicately controlled motors necessary for the observatory service. It only needs to be added that the line has been in operation six months and has gone through several severe storms without the slightest difficulty. So much for the temperament that makes its own precedents.

Methods of Protective Lighting

AS OUR war industries increase in volume and importance there is added risk of malicious interference with them by the enemy, whether aliens who have escaped internment or alleged neutrals who make it their business to interfere with the production of war materials. The old adage that an arc lamp is as good as a policeman is one constantly to be borne in mind in the protection of war plants against criminal malice. Mr. Magdsick's article on this subject last week excellently summarized the methods which have been found most practical in dealing with the somewhat intricate problem of protective lighting. They followed closely the suggestions of Mr. Leigh of the Military Intelligence Bureau, who has made a specialty of this plant protection and is at the head of that work for the government. Broadly, the dangers to an industrial plant are either external or internal. The external dangers are chiefly those concerned with arson, and incidentally with the damage of finished material within reach by any available means. These external dangers are, on the whole, the more serious because of the greater opportunity for mischief on the part of the workmen actually employed in the plant than on the part of outsiders seeking to break in. Most of the damage that has been done, and it is very serious in the aggregate, is chargeable to what the police call "inside jobs," ranging from sabotage to fires and explosions. Only when the strong arm of the law falls heavily upon the enemies of production will this condition cease.

For protection against damage from the outside, good lighting around buildings and yards, bright enough to disclose quickly the presence of interlopers, is all important. Just how it can best be carried out depends very largely on the local situation. The two general schemes of operation are by means of floodlamps and powerful distributed sources in suitable reflectors. To what extent each of these should be employed depends on the nature of the area to be guarded and the scheme for guarding it. Immediately around buildings there is probably nothing better than well-placed large incandescent lamps in reflectors adapted to light the buildings without throwing too much glare in the eyes of the guards. The task of lighting industrial buildings is rendered much easier if they are not too dark in hue, a light-colored concrete, for instance, being very much better than brick. The chief usefulness of floodlamps is in reaching out and illuminating long approaches, extensive stretches of protecting fence and other spaces where for one reason or another it is inconvenient to place lamps, or for that matter to locate guards. A guard under or behind a floodlamp gets an admirable view of its illuminated track. Unless the lamp be placed fairly high he may be bothered by the glare if executing a patrol through the illuminated region. In general it would seem most practical to use floodlamps with guards placed with reference to the lamps rather than to the space lighted. Of course, along water fronts and similar situations floodlighting is likely to do excellent service.

Inside lighting needs to be thorough rather than very brilliant. The chief thing is to have no dark corners where an evilly disposed person may lurk out of the watchman's view. The interior must be lighted so that, either by direct illumination or by seeing a silhouette against the light, a guard may spot instantly the presence of any unauthorized person. For the inside protection lighting therefore big lamps are not essential or generally desirable, but rather well-distributed lamps so placed as to cast no troublesome shadows and to free the eye from glare. In general, then, proper protective lighting is likely to consist of illumination of boundaries and approaches either by distributed lamps or carefully placed floodlamps as convenience may dictate; lighting of the buildings themselves chiefly by moderately powerful units placed high to avoid glare, and, finally, inside illumination well distributed, of moderate intensity and designed with special reference to the avoidance of shadowed spaces which interfere with the watchman's vision. On the whole, the interior lighting is practically quite as important as the exterior.

Storing Coal for Next Winter

SINCE only by constant repetition does a thought finally become fixed, we again bring up the subject of the storage of coal. Elsewhere in this issue there appears a letter from the Fuel Administration which speaks for itself. Dr. Garfield is also quoted as saying that there will be lightless nights and heatless days this coming winter. The coal shortage is a very real thing, and all prudent men will heed the warning. Central-station companies cannot afford to be negligent in this matter. If they can get coal, they should by all means do so and store it to the limit of their resources.

The Coming Issues

IN THE next issue there will appear abstracts of the papers to be presented at the Atlantic City convention of the American Institute of Electrical Engineers, which is to be held on June 26, 27 and 28. An article by James R. Cravath outlining some of the central-station commercial possibilities contingent on the coal situation will soon appear, as will a short description of two government nitrate plants now in the process of erection and a discussion of the relation of the war to power factor. There is also scheduled an article on utility rates. These will be in addition to the regular operation and commercial and management sections of the paper.

John W. Lieb's Presidential Address

Discussing "The Electrical Industry in War Service," the Retiring President of the National Electric Light Association Expresses in Vigorous Terms Our Determination to Support the War Program

The address of President Lieb "with singular clearness and in the broadest spirit reflects the attitude of the association and its members toward the great problems which are confronting our country at this crisis in the world's history.

"It is clearly our duty, as he so admirably indicates, to use every possible human effort, to make every sacrifice and to devote our time to the supreme business of the moment—the winning of the war, to the successful conclusion of which every true American should be pledged."

[From the report of Samuel Insull, Joseph B. McCall and Charles L. Edgar, the committee on the presidential address of Mr Lieb, made before the annual convention at Atlantic City on June 13 and 14.]

"A YEAR ago last May, after a long period of patient endurance of unfriendly provocations and brutal violations of international agreements," began Mr. Lieb, "our country decided to draw the sword and come to the support of the gallant nations, now our heroic allies, who for three long years had been fighting desperately against a powerful and conscienceless enemy. No nation ever unsheathed the sword with greater reluctance, with greater justification and in the defence of nobler ideals. We were certainly not the aggressors, and we entered the fight with a clear conscience animated by a righteous purpose.

"It has taken us a whole year to appreciate the nature of the titanic struggle that is taking place overseas, 3000 miles away, and we are only just beginning to visualize the part we are called upon to play and the aid we must render to bring this terrible conflict to a victorious conclusion. Our industry was not slow to recognize the active and important service which it would be called upon to render, and at its annual meeting shortly after the declaration of war it made ready for an immediate mobilization of its resources to give every possible assistance to the government.

"As we look back upon the year that has been spent so largely in the work of preparation for our active and telling participation in the conflict, we may find some basis for faultfinding and criticism, but if we take a broadminded survey of the whole field and consider all the circumstances and conditions surrounding our national life, we must come to the conclusion that what has been accomplished is nothing short of miraculous; and we have reason to marvel at the stupendous scale on which the deep and broad foundations have been laid for a structure adequate to support the temple of victory which, in co-operation with our valiant allies, we shall rear no matter at what sacrifice of life and treasure."

Extent of the Industry

Mr. Lieb then showed the great extent of the wider electrical industry and of the electric light and power portion. Including the electric railway, the telephone and telegraph systems, the electric light and power systems and the manufacturing enterprises on whose output these enterprises are dependent for their apparatus and equipment, the industry gives employment to over 920,000 men, represents an invested capital of about $10,750,000,000 and an output valued at $2,675,000,000 per year. The most recent statistics available indicate that in the electric light and power branch of the industry there are employed approximately 125,000 men with an invested capital of $3,000,000,000 and doing an annual business of roughly $575,000,000.

Interconnections

The first of the important problems discussed by Mr. Lieb was the interconnection of the regional generating and transmission systems. In discussing this he said:

At the present time there is imperative need that our member companies take an advanced position in this matter, as they have done in so many other directions, in order that every possible advantage may accrue to the nation and its war necessities.

Where demonstrable economic and service advantages are obtainable from such a plan of operation, if the utility companies themselves do not take the initiative in their consummation it will surely be done under some form of governmental control, as the nation must obtain for itself in these times all the advantages which may contribute notably to the solution of the one great aim and object of all enterprises and business at present—the winning of the war!

The member companies of this association . . . conspicuously among all the national industries have known how to obtain from their employees the enthusiastic loyalty and co-operation which have been the foundation of the high standards of service they have been able to maintain and on which their prosperity and the good will of the public which they enjoy have been largely built up. This devotion to duty of the employees is an essential prerequisite also to successful co-operation between extensive interconnected systems.

General Economic Conditions

In citing the general facts as to the increase in cost of rendering service, Mr. Lieb commented: "Every other industry in the country, with the conspicuous exception of the steam railroads, has been able to meet similar conditions by an increase in the price of its product, and we have therefore experienced increases of 100 to 200 per cent and even more in the cost of all natural and manufactured products."

Discussing commission control, he added:

The commissioners have not shown the flexibility and alacrity in raising rates that they have become accustomed to show in the almost continual process of lowering them during the past decade.

But it is not only the shareholders that have seen a curtailment of their return on their investments and the deterioration of their property; the public also has suffered in impaired service, in curtailment of facilities and in the inability of utilities to provide funds for extensions and expansion to meet the demands of the public for additional service.

The situation is most serious and requires the earnest and urgent consideration of the national government.

The extraordinary conditions under which the electrical industry is now operating should call for the most liberal and responsive treatment of the applications for service which are overwhelming many utilities for such important

war service as navy yards, arsenals, shipbuilding, munition and nitrate plants, cantonments, etc.

It is not only difficult to finance these extensions, but the apparatus and supplies are hard to get; their cost is double and treble pre-war prices, labor is scarce and demands continually higher compensation, with the result that generating plants are becoming overloaded and the transmission and distributing circuits inadequate. Moreover, many of these demands for service are of a temporary character, often difficult to define as to amount and duration of service required, for which, particularly in direct government service, guarantees as to revenue to be expected are not obtainable. On the whole, the utilities throughout the country have responded splendidly to the demands made upon them.

It is not, however, amiss at this time to issue an appeal to every central-station company in the country to go to the very limit of its power in meeting the urgent requirements of the government and to respond in a spirit of patriotism and sacrifice to the needs of the nation.

COAL PROBLEMS

Utility managers, said Mr. Lieb, are looking forward with much concern as to what the coming winter may have in store for them on the serious problem of adequate coal supply. Discussing the causes, Mr. Lieb said in part:

It was indicated by some authorities that the coal famine was due to a shortage of labor at the mines; by others the reason assigned was lack of coal cars; by others it was attributed to a breakdown in the transportation system, and again it was held that the seat of the trouble was at the railroad terminals at tidewater. A more conservative opinion assigned a cumulative cause, in which each of these factors played a constituent part of greater or less importance, some being the relation of cause and effect.

It would require a more searching investigation than any that has yet been made to determine the effect which the prices fixed at various times by the government or previously by voluntary agreement had on the coal mined. But the difficulties experienced were not alone from scarcity of coal but also from the irregular and generally inferior quality.

In discussing the efficiency of central-station plant operation, Mr. Lieb expressed the opinion that it will be impracticable to obtain at this time any noteworthy improvement in power-house fuel economy from any radical improvement in operating methods, as a measure of fuel conservation. He continued:

The outlook for savings in other directions is not, however, quite so discouraging. There are certain possibilities in the saving of fuel from the joint operation of neighboring plants which may, through "linking up," improve their load factor and utilization factor and achieve economies due to the operation of the most efficient units of both plants the bulk of the time, and the operation of the most efficient units fully loaded in one of the plants the remainder of the time. It must not be assumed, however, that it will always be found easy to carry out such interconnection, for the outlying districts of each, if joined, will hardly permit considerable interchanges of current, and the extension of tie lines into sections of sufficient capacity will require an engineering study of each individual case.

Much has been said and written recently of the possibilities of joint operation between central-station systems and isolated or private plants operating within the same territory. It does not need demonstration that the coal consumption in the isolated plants is generally from two and a half to four or five times the amount of coal required to produce the same quantity of electrical energy in the central station. The private plant usually requires more or less steam for heating or for the operation of auxiliaries, which may be obtained wholly or in part from the live steam of the boilers supplementing or taking the place of the exhaust steam. These figures would in such cases be somewhat dependent in their relative values upon the conditions presented by each individual case; but the fact remains that on the whole there would be a notable coal saving in the operation of all the requirements throughout the territory for light and power from the central electric station with local steam heating for individual cases where it cannot be obtained from a central heating system.

Consideration has also been given to the joint operation of the street system and the private plant, but this plan presents such practical and economic difficulties that it can hardly be considered practicable.

PREVENTING WASTE

Showing that the companies fully co-operated in enforcing sign-lighting restrictions, Mr. Lieb, after mentioning the industrial curtailment, called attention to the daylight saving law, which he urged be made operative all the year.

Development of our stupendous unused national asset in water powers was urged by Mr. Lieb.

Consumers should be advised, Mr. Lieb said, to use "every care not to waste light and to avoid excessive and unnecessary use of light in interiors and limit to reasonable proportions the use of advertising, display and purely decorative exterior illumination.

"As to the use of carbon and 'gem' lamps, it has been found that while the demand for these less efficient types is constantly decreasing, there is still a certain demand for these lamps and particularly for the least used carbon lamps for particular services, such as in construction work, garage and inspection use, etc., where only the more robust carbon filament is able to resist the effects of vibration and rough handling."

LABOR CONDITIONS

Calling attention to the great rush of enlistment and volunteering and to the calls of the National Army, Mr. Lieb said that it was not these that caused serious concern, but the withdrawal from service in response to the inducements offered by munition factories, shipbuilding plants, navy yards, power factories, nitrate plants and the construction camps of cantonments, warehouses, etc.

Expressing sympathy for the position of the clerical staffs under the burden of high cost of living, Mr. Lieb discussed the position of women and of crippled soldiers in industry. Mr. Lieb went in detail into the question of rates and rate increases, saying in part:

In the applications that have been made to public service commissions by member companies for increased rates it has been noted that in many cases they have taken the shape of the addition of a service charge to the normal or a reduced charge for energy.

Where a service charge is introduced into the rate schedule it should not be considered as a temporary war measure, as it implies a fundamental change in the basis of rate making and a modification should be made only with a view to substantial pressure.

Increases, if temporary and made as a war measure, should take the shape of a surcharge, percentage increase or flat addition to the maximum rate or base rate, whatever it may be, so that its elimination at the proper time may not cause a new dislocation of the whole rate structure.

It is gratifying to note an increased responsiveness by regulatory bodies with less insistence when considering application for rate advances on all the forms of procedure usually applied in rate cases and a readiness to use short cuts and common sense approximations in place of the dilatory, expensive and labor-causing processes of appraisal, valuation and other forms of exhaustive investigation considered necessary under normal conditions. It has been found that in general regulatory bodies have been loath to grant increases in the maximum rate but have been more responsive to make increases in the industrial or class rates, increases in the power rates being granted with little hesitation.

Long Spans Facilitate Mountain Service

Steel Cables Are Utilized and the Sag Is Increased Wherever This Is Found to Be Possible—Special Dead-End Construction Is Employed for the Purpose of Withstanding Stress

BY N. B. HINSON
Department of Distribution Southern California Edison Company

INCREASED demands for power at the Carnegie Institute Observatory on Mount Wilson, 16 miles (25.7 km.) from Los Angeles, recently made it necessary either to extend the oil-engine-driven generating plant which has been supplying energy or to purchase central-station energy. Extension of the isolated plant was not looked on with much favor, however, because the oil has to be hauled up the mountain, which is 5886 ft. (1794 m.) high, over a road 9½ miles (15.3 km.) long. Furthermore, in winter there are times when the roads are impassable, so that oil has to be stored to tide over periods of poor delivery. Providing service from the nearest central station involved difficulties too, but, after studying various routes and making estimates of the cost of construction to see if the line was feasible, it was found preferable to the alternative method considered.

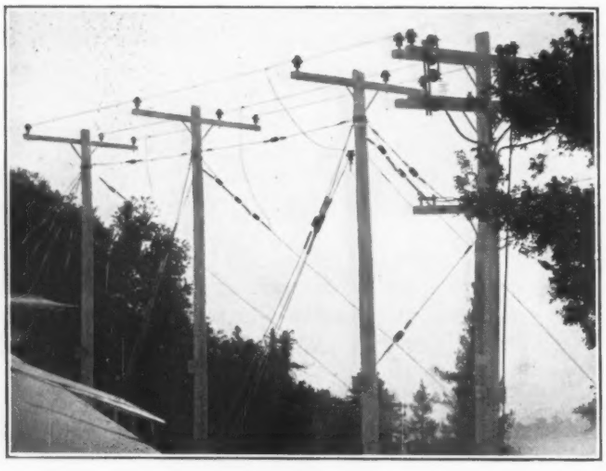


FIG. 1—DEAD-END AT MOUNTAIN TOP
Cross-arms carry busbars; air-break switches on nearby pole are operated from ground; the choke coils connect with underground circuits; at the left are the engine house and motor room.

The nearest power line, which belonged to the Southern California Edison Company and was operated at 15,000 volts, was about 7 miles (11.3 km.) away by air line measurement or 12½ miles (20.1 km.) by road. All but 3 miles (4.8 km.) of the road was over rugged mountains. Some of the canyons are 2000 ft. (609.6 m.) or more deep, and the mountains are heavily wooded in places with pine trees 100 ft. to 150 ft. (30.4 m. to 45.7 m.) tall.

It was impracticable to build a regular pole line along the road; therefore a line was strung as nearly straight as possible between the point of interconnection and the observatory. This involved some long spans across canyons, practically the whole route consisting of seven long spans. The average span is 2071 ft. (631 m.), the longest 3263 ft. (994 m.), that is, measured horizontally between poles, and the greatest difference in elevation is 945 ft. (288 m.) with a horizontal span of 2293 ft. (698 m.). The horizontal distance from the starting point of the first long span to the substation on the mountain top is 17,548 ft. (5348 m.), and the vertical distance is 4114 ft. (1254 m.). While the average grade is 23.4 per cent, there is a comparatively flat section about one-third of the way up, so that the actual grade is even greater.

FEATURES OF CONSTRUCTION

To support the lines on these long inclined spans, some of which are also subjected to ice, sleet and snow, special conductors, insulators and supports have to be used. The line conductors consist of 5/16-in. (7.9-mm.) Siemens-Martin extra-galvanized seven-strand steel cable. Tests were made on samples of the cable to determine their elastic limit and maximum strength, which averaged 4800 lb. (2177 kg.) and 7800 lb. (3538 kg.) respectively. The minimum sag employed allows for a stress equal to two-thirds of the elastic limit, a 30-mile (48.3-km.) wind pressure and 2 in. (5.1 cm.) of ice on the three upper spans, but no ice on the other spans. The reason for this is that the two upper spans are on the north side of the first range and the rest of the line is on the south side, which is not subjected to sleet or ice. Wherever the sag could be increased without reducing the ground clearance below an allowable value it was done.

If standard suspension insulators had been used, the mechanical factor of safety would have been very low; for this reason it was decided to use strain insulators in series. Three Westinghouse 6600-volt type PS insulators were therefore connected in series, the insulators in each string being joined with each other and the cross-arms with cable similar to that used in the line.

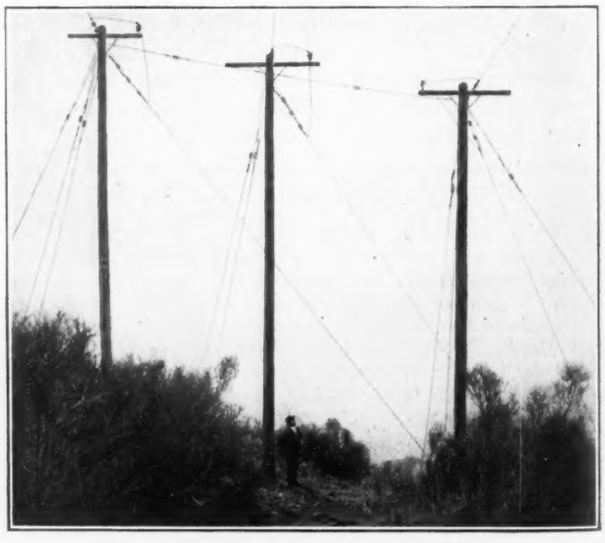
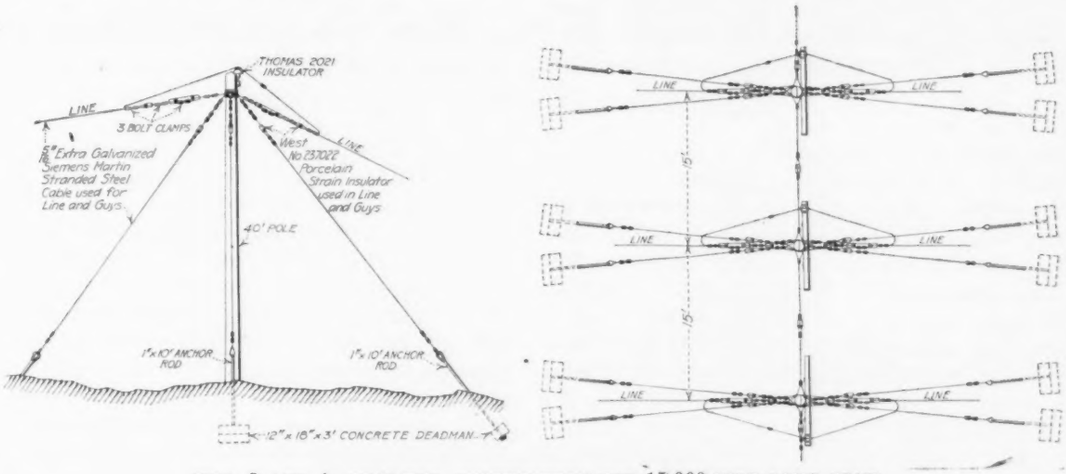


FIG. 2—DEAD-END AT TOP OF FIRST LONG SPAN

Two three-bolt clamps were employed in making these connections. The jumpers between dead-end points are supported on pin-type insulators. This construction possesses the advantage that should an insulator break the line will not drop. According to tests made on the strain insulators, the dry flash-over voltage of a single unit is 52,000 volts, the wet flash-over is 14,000, and the maximum strength is 17,760 lb. (8052 kg.).

except one, where the poles were trolleyed in, the poles could be "snaked" in from the road.

Various methods were tried to stretch the line across the canyons, but the one which permitted the quickest work was to cut a trail and carry a rope across. By using rope in 1000-ft. (305-m.) lengths with snaps at each end the construction crew was able to coil and handle the rope easily. As the cable used was on reels



FIGS. 3 AND 4—DEAD-END CONSTRUCTION FOR 15,000-VOLT LONG SPAN

The line is supported at the end of each span by three 40 ft. (12-m.) poles which have been shaved, treated and painted. They are set 6 ft. (1.82 m.) in the ground, 15 ft. (4.57 m.) apart and are anchored in four directions. On the extra-long spans two anchors are used on each pole, the anchors consisting of reinforced-concrete blocks 12 in. by 18 in. by 26 in. (30.5 cm. by 46 cm. by 66 cm.) with 10-ft. (3-m.) galvanized rods, 1 in. (2.54 cm.) in diameter. The guy-wire material is similar to that used in the line. One strain insulator is placed in each guy.

FIG. 5—ELECTROLYTIC LIGHTNING ARRESTERS MOUNTED ON ONE POLE

This installation is near the substation at the foot of the mountain. The 15,000-volt lines enter the substation as underground lead-covered cables.

In order to transport the poles through the winding mountain roads a special rack was built on a truck over the driver's seat so that the poles could be supported on the truck with the tops pointing in the air over the driver's head. The butts rest on the bed of the truck. This arrangement permitted turning the truck around curves which could not have been negotiated if 40-ft. (12-m.) poles had been transported flat. Five poles were carried at a time. At all points in 5000-ft. (1524-m.) lengths it was not necessary to make any splices in the spans.

The line in the valley is of standard construction, consisting of 300-ft. (91.4-m.) spans and 0.25-in. (0.63-cm.) guy wires for conductors. In the foothills the same type of construction is used, but the spans are longer. The entire line loss is less than 2 per cent. Probably there will never be much increase in load. The line is protected with electrolytic lightning arresters at the lower end and graded shunt-resistance multi-gap lightning arresters at the top. Electrolytic arresters could not be used at the top owing to the great variation in temperature and the very low temperature during the winter months.

The substation at the top of the mountain is built of concrete and is situated in the side of the hill. Fifteen-thousand volt cambric-insulated cable inclosed in con-

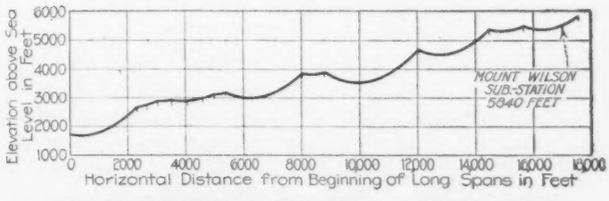


FIG. 6—APPROXIMATE PROFILE OF LONG-SPAN LINE

duit runs from the overhead line to the transformers. A pole-top switch with fuses and choke coils is provided at this station, while at the lower end of the line is an automatic 15,000-volt oil-break switch. Two motor-generator sets in the observatory substation convert the three-phase, 50-cycle, 200-volt current from the transformers to direct current, which is essential for the work in the observatory. The isolated plant, which includes a storage battery, is still in use and will help to supply energy if any line interruptions should occur. Three-phase local service is furnished to a hotel and

camp near the observatory at 2200 volts from a step-up bank of transformers in the substation.

The line was built by the regular construction crew of the Pasadena district of the Southern California Edison Company and has been in operation about six months. No trouble of any kind has been experienced, although it has been subjected to two severe wind storms.

Vigorous Fuel-Saving Campaign

Critical Condition of Coal Supply for Next Winter Led to Organized Plans for Economy in Power and Lighting in New England —Improvement in Boiler-House Practice

NEW ENGLAND faces a critical coal-supply situation next winter, and energetic efforts to forestall a famine are under way with Fuel Administrator James J. Storrow of Boston in the lead. A campaign is on to arouse the industrial plant owner to the vital importance of the economical use of coal. Meetings have been held at Boston, Worcester and elsewhere in the interest of fuel saving, and it has been "put up" to the manufacturers that a total of at least 3,000,000 tons must be saved this year by more efficient plant operation.

Water Shipments Far Behind

In a statement which Mr. Storrow issued recently he points out that every economy possible must be practiced since the demands for coal for the calendar year will be greater than they were during 1917 and because water shipments up to the present time are far behind the rate at which they should be coming in if the total amount of coal required (34,000,000 tons) is to be received. Practically two-thirds of this should be delivered by water, but it is doubtful whether this quota can be delivered by boat as all vessels that are available must be used for transporting expeditionary forces overseas. Still the forces at the front must be supplied with food, clothing and munitions. While the railroads have just about met the estimated requirements, it is doubtful whether they can make up any shortage incurred by poor deliveries so far, especially when inclement weather sets in. The situation is made more serious than last year also by the fact that no reserve stocks are on hand as there were at the beginning of the winter of 1917.

In view of the existing conditions, Mr. Storrow has appointed a committee of prominent engineers who will aid the Fuel Administration in carrying out a carefully prepared plan of reducing coal consumption in industrial plants. The committee consists of Dr. Ira N. Hollis, president of the Worcester Polytechnic Institute; Charles T. Main of Boston, president of the American Society of Mechanical Engineers; George P. Gilmore, Fall River; Arthur T. Safford, Lowell; Joseph A. Skinner, Holyoke, and W. G. Starkweather, Boston. Every manufacturer is requested to appoint a permanent factory fuel committee, selected from executives and foremen, and to engage the temporary services of a consulting engineer to advise the committee in the following work: (1) Increasing the efficiency of steam and power generation; (2) equalizing the load on the power plant and reducing to a minimum all friction and idle machine loads; (3) economizing in the use of steam for heating and process work; (4) reducing artificial lighting to a minimum.

Work along the foregoing lines has already been undertaken by several manufacturers with a resulting saving of from 10 to 33 per cent of the coal used. A booklet outlining the fuel-saving plan has been prepared for distribution by the Fuel Administration, and copies have been mailed to manufacturers with pledge cards. The booklet contains four reports showing the actual methods and results of fuel saving in four Massachusetts industrial plants, and it requests that each manufacturer eliminate all waste in the use of both steam and hydroelectric power and advise the Fuel Administration as to his willingness and extent of co-operation.

The economies which different plants have effected have resulted from efforts along many lines, including improvements in methods of heating, changes in the use of steam, modification of process methods, etc., but only such practices as effect the generation of steam, development of power and the utilization of electrical energy will be referred to here.

Improvement in Boiler-House Practice

The general manager of the Crompton & Knowles Loom Works, Worcester, Mass., reports: "On taking up the matter at the beginning of the winter we felt that it was necessary to have a suitable organization for carrying on our fuel conservation policy, and we therefore appointed from our foremen and executives a so-called shop fuel commission.* A little later we appointed a shop fuel administrator, so to speak, whose business it is to follow up the various methods inaugurated, to see that the best results are accomplished therefrom, and also to see that continued interest is maintained."

Among improvements which have been made in boiler-house practice are the following: (1) Raising temperature of feed water by return of condensation. The temperature of feed water entering the boilers has been raised from 180 deg. Fahr. to 200 deg. Fahr. thereby. (2) The establishment of better boiler-room practice by putting observers in the boiler rooms for several days and nights to determine rate and efficiency of firing. The usage of coal by half-hour periods, as fired, was recorded for many days and plotted, from which was evolved a better practice as to uniform and more economical firing. (3) The weighing of all coal supplied to the boiler room and only allowing a certain amount of same to be used in definite periods. The remainder of the coal was locked up, so that the fireman had to be economical in the use of the portion that was issued to him. (4) Installation of pin-hole grates and under-grate blowers to allow use of screenings. While

*Consists of boiler-room operator, engineer, factory superintendent, assistant superintendent of power and a general inspector.

the screenings have not been very high grade, there have been many days when through the use of these practically no soft coal was used whatsoever. The screenings are being analyzed and the use of all screenings that show an unusual percentage of dirt and ash is being discontinued.

The Atlas Tack Company, Fairhaven, Mass., has covered the tops of its boilers with asbestos cement 2½ in. (6.4 cm.) thick, lowering the outside temperature 10 deg. thereby. In addition, water columns and high-water and low-water alarms have been installed on all boilers to prevent wide fluctuation of water level and assure better economy. On each boiler is also a boiler efficiency meter which shows the firemen at all times the condition of their fires. This has proved a very useful and economical instrument.

A V-notch recording and indicating water meter has been installed to show the boiler-room force the amount of water evaporated per pound of coal. On account of the limited tube area in the feed-water heater formerly used it was impossible to get the best results from exhaust steam, so the tubes have been replaced by a more efficient set, resulting in a 20-deg. increase of temperature. Economizers are also used. The boiler-feed pumps were repaired and put in first-class condition and all engine valves are set for the highest economy. The company is about to install a 5-hp. motor to take the place of a steam engine to run the economizer scrapers.

Hand-stoker grate bars are being installed which, according to the builders' rating, will give about 50 per cent more boiler rating and about 25 per cent saving in coal. An old cooling tower which was inefficient has been abandoned and a spray-pond condensing equipment substituted. The 3-in. to 4-in. (7-cm. to 10-cm.) more vacuum which can be obtained as a result should lower the coal consumption for power alone about 162 gross tons per year. In addition, all boiler settings and brickwork are being examined for necessary repairs and provision is made for scraping the boiler tubes.

It is thought that the increased efficiency which will result from these changes in 1918 will net a saving of at least 20 per cent in fuel.

Experiments with Asbestos Covering

At the George E. Keith Company, Brockton, Mass., the engineers have experimented to some extent with asbestos covering on the brickwork of the boiler settings. Undoubtedly this covering will be applied to all the boilers. The covering not only cuts down the loss due to heat radiation, but also stops any air leakage. The company was driven to the burning of screenings because it could not obtain soft coal. In fact, it has been doing so in some of the boilers for two or three years with good results. Small forced-draft blowers were installed to get results, as high as 70 per cent of screenings having been burned with soft coal.

Another saving has been effected by piping all condensation returns to the boilers, thus eliminating the expense of make-up water, as a boiler-feed temperature of about 206 deg. is obtained. It has been made a practice to burn all the scraps and waste from the factories, such as paper, shavings, sawdust, etc. Shortly the company intends to build a central plant which will take the place of three isolated plants. In this it will install automatic stokers, weighing devices for recording the amount of coal used, and coal and ash-handling apparatus.

Economy in the Use of Power

The Crompton & Knowles Company has minimized the waste of power as follows: (1) Under the direction of a shop fuel commission, the number of idle machines on which belts had not been thrown off was observed by an inspector. Vigorous action with the foremen resulted in the number of machines running idle and wasting power being reduced to an absolute minimum. This was accomplished principally by the installation of hooks to permit the handling of idle belts. (2) The studying of the load on every motor throughout the shop. Where the load was not sufficient to get the maximum efficiency from the machine conditions were changed to make this possible. All cases of motors working underloaded were eliminated. (3) All overtime that involved the inefficient operation of machinery was stopped. (4) The use of large elevators was restricted to actual needs. This resulted in the elimination of several hundred trips throughout the day.

Curtailing Unnecessary Lighting

The saving in fuel in connection with the use of lights was large and accomplished in three ways, particularly: (1) By the development of interest on the part of the foremen in connection with the actual inspection at various times of the day of lights used. This resulted in the cutting out of a large number of unnecessary lamps. (2) By replacing carbon lamps with tungsten units. The usage of carbon lights had been continued to use up a stock of these on hand, which practice was discontinued. (3) By reducing the wattage of lamps in places where the existing illumination seemed unnecessarily high. This also resulted in a marked saving.

At the Dennison Manufacturing Company, Framingham, Mass., a reduction in the general illumination around the plant was made. Where under ordinary conditions the general lighting system would be used the amount of light used under the existing conditions was cut down to the minimum and in some places discontinued. Lamps of lower candlepower were substituted in many cases for a larger-sized lamp; this was especially true in stair towers, toilets, bridges, etc. The time when lights were turned on was curtailed. Sign lighting was discontinued, and the street-lighting and factory yard lights were reduced to a minimum consistent with the safety of the plant and the prevention of accidents to employees. The watchmen were instructed to see that unnecessary lamps were not left burning where night work was going on or at any time outside of working hours. All electric and gas-heating applications were turned off from ten to fifteen minutes before closing time. Lamps of less candlepower were used for all indicating lamps and on instruments in the power house.

In order that the peak load due to lights should be eliminated, all passenger service on elevators was discontinued when the lighting load came on, and certain heavy machines, such as the coal carrier in the power house, paper calenders, machinery in the carpenter shop and certain elevators, were shut down at 4 o'clock or thereabouts. As a result the total power and lighting load curve is practically flat throughout the day.

Readjustment and Reconstruction Commission—III

An Account of the Work That Is Being Accomplished in Great Britain by the Ministry of Reconstruction in Preparation for the Great Changes Sure to Come When Peace Is Once More Established

BY WINGROVE BATHON
Washington Representative ELECTRICAL WORLD

PREVIOUS articles in this series have suggested and urged the appointment by the President of the United States of a readjustment and reconstruction commission, to begin to deal now with vital problems in industry which will be presented after the war. It was pointed out that many other countries, notably Great Britain, have already begun to attempt to solve after-the-war problems, and the suggested personnel of a suitable commission, selected from the ranks of American industry, was presented in the first article in this series, the second article dealing in turn with the suggested personnel for a suitable advisory council, taken from the ranks of government officials, to work with such a commission.

WHAT GREAT BRITAIN IS DOING

It was promised that this third article should describe some of the far-reaching work being done along this line by Great Britain, and this is now done as an evidence that it is necessary for American industry to begin now, through a readjustment and reconstruction commission, preferably the President's own commission, responsible only to him, to prepare to solve after-the-war problems. It may be as well to state at the beginning that this description of Great Britain's Ministry of Reconstruction is taken from the official reports to Parliament of the British War Cabinet, furnished to the present writer for the purpose of this article by Arthur Willert, secretary of the British War Mission at Washington. These reports are inclusive of the year 1917 and have just been sent to Washington.

After tracing the earlier stages of the Ministry of Reconstruction in Great Britain, before the ministry was established by the new ministries act, in July, 1917, and when and during the time the agency of reconstruction consisted of a committee of ministers of the crown, the War Cabinet reported that it was found necessary to establish a Ministry of Reconstruction to continue for the duration of the war and for a period of two years or less after its conclusion. It was declared that a Prime Minister, upon whose shoulders fell the responsibility for the conduct of the war, could not personally assume a day-to-day responsibility for guiding the reconstruction committee's work. It was stated that the government had throughout been aware that as the war continued and its pressure upon every side of the national life increased the intensity of the struggle in itself enhanced the importance of the reconstruction problems which had to be faced, and that Parliament and the country were not slow in realizing that there were coming into existence a series of questions of the utmost importance to which answers must be found, not after, but before, the conclusion of the war.

The functions of the Minister of Reconstruction then appointed, and who assumed office in August, 1917, are defined as follows:

"To consider and advise upon the problems which may arise out of the present war and may have to be dealt with upon its termination, and for the purposes aforesaid to institute and conduct such inquiries, prepare such schemes and make such recommendations as he sees fit, and the Minister of Reconstruction shall, for the purposes aforesaid, have such powers and duties of any government department or authority which have been conferred by or under any statute as his Majesty may by order in council authorize the minister to exercise or perform concurrently with, or in consultation with, the government department or authority concerned."

In other words, as was brought about during the debate which resulted in the creation of the ministry, the minister in charge does not exercise executive functions. He appoints committees, he initiates experiments, he frames schemes for action with a view to conditions after the war; his powers are not exclusive and do not shut out other departments; he assists the other departments, provides them with information and helps them to "build a bridge which will safely carry us over from war to peace conditions." The British Parliament found that the creation of a reconstruction agency was desirable because various government departments are approaching various problems in their own way, each drawing up reports or memoranda, and that what was needed was a co-ordinating element, not especially attached to the work or to the traditions of any one of the departments concerned. The Solicitor General of Great Britain, speaking in debate, declared that what was needed was "a comprehensive co-ordinating mind, a fresh mind, and at the same time an authoritative mind, who will bring together the several contributions of the various specialized departments."

FUNCTIONS OF THE MINISTRY OF RECONSTRUCTION

The Ministry of Reconstruction was then formed. For the purpose of administration the department was divided into branches dealing respectively with commerce and production, including the supply of materials; with finance, shipping and common services; with labor and industrial organization; with rural development; with the machinery of government, central and local, health and education, and with housing and internal transport.

The Minister of Reconstruction then appointed an advisory council, "representative of all the leading interests concerned in reconstruction, and it is his hope by consulting the council freely and regularly to secure a representative consensus of opinion on any proposal which may be referred to him for advice or which may be initiated in the department." This council is organized very much as the Pan-American financial conference held in Washington at the beginning of the war was organized and very much as the old War Industries Board of the Council of National Defense of the United States was organized. In other words, there

are experts in each line named to serve with government representatives. The council is divided into sections, just as the administration of the Ministry of Reconstruction is divided. It is stated that "the membership of the council has been so arranged that in each section all the principal interests represented on the council should find a place; thus there are representatives of labor on the finance section as well as financiers; there are business men as well as agriculturists on the section dealing with agriculture, and so on."

The meetings of the sections of the ministry and the council are private, but it is known that they have already dealt with the standardization of railway equipment, the post-war rationing of industries, the establishment and functions of trade organizations, the organization of rural information centers, the establishment of industrial courts, house planning from the point of view of domestic economy, the future organization of voluntary women's work, and the conditions required for maintaining a supply of efficient agricultural labor.

WORK OF THE DIFFERENT SECTIONS

The section dealing with commerce and production is investigating: (1) the supply and control of raw materials after the war; (2) financial facilities for British commerce and industry after the war; (3) the preservation of industries which will play an essential part in reconstruction but are in extinction through failure of supplies of material or labor; (4) financial risks attached to the holding of trading stocks; (5) trusts and combinations, with special reference to the protection of the consumer; (6) the establishment of new industries after the war, a committee having been especially appointed to consider this question as far as the engineering industries are concerned, a parallel committee considering the labor questions involved; (7) the volume and nature of the demand for British goods after the war, and (8) improvements in trade organization for the purpose of more economical production, distribution and marketing, and expediting the turnover from peace to war.

The section dealing with finance, shipping and common services is, in conjunction with the Treasury, considering the question of currency and exchange after the war, and under this section an advisory council section is at work on the disposal of government stores after the war.

The section dealing with labor and industrial organizations has agreed with the British Board of Trade and the Ministry of Labor that "a concerted effort should be made to promote in as many industries as possible representative organizations to advise the government as to the views and needs of the industries on the various industrial and commercial problems that will affect them during the reconstruction period. The Ministry of Labor is to proceed with the formation of permanent industrial councils. A conference of trade organizations is being established at the Ministry of Reconstruction, consisting of three employers, three trade unionists and representatives of the Board of Trade, the Ministry of Labor and the Ministry of Reconstruction. The Minister of Reconstruction has decided to refer to the industrial section of the advisory council the question of establishing corresponding organizations in engineering and in railways.

This section (dealing with labor and industrial organizations) is farther along with its work than any of the other sections, apparently, for reports have been submitted on unorganized trades and works, and probably by now on conciliation and arbitration; a general survey of industrial policy as a whole has been prepared, going into the law and labor in merchant shipping, war-time departures from trade-union practices, industrial courts, industrial structures, apprenticeship, the reinstatement of returning soldiers and sailors and international labor legislation. Furthermore, surveys have been undertaken of industrial methods; inquiry is being made into juvenile employment; the question of army demobilization, it has been settled, makes the Ministry of Labor responsible for the returned soldier or sailor, and the Ministry of Reconstruction is to determine the priority of different trades. A complete list of public works which have fallen into arrear has been prepared so that surplus labor may be usefully and rapidly employed, and the Ministry of Munitions has begun work on the special problems arising out of its work.

The section dealing with rural development is examining: (1) the working of the small-holdings act and the future of urban war allotments; (2) a report made by the forestry committee; (3) the rural housing problem; (4) the organization of county offices for advice on agriculture; (5) tithe redemption; (6) village industries, and (7) the report of the land acquisition committee.

The section dealing with machinery of government, health, education, etc., is negotiating through a committee on the distribution of functions in regard to the formation of a ministry of health and is studying reports which have been made (1) on the functions of the poor law authorities and (2) on adult education.

The section dealing with housing and internal transport, with a view to facilitating work in connection with housing, has set to work committees on (1) supply of building materials, (2) house-building construction, and (3) building by-laws. Special investigations are being made by this section on (1) control of public utility societies, (2) town planning, (3) rings in the building trade, (4) the working of the small-dwelling acquisition act, and a general review of the problem of inland transport is being made, the portions dealing with roads and canals having been completed. Furthermore, the ministry is in consultation with the Board of Trade concerning the future of the railways (including light railways) of Great Britain, and an inquiry has been begun into the question of storage and distribution as essential elements in transport policy.

COMMERCE AND PRODUCTION

In the section dealing with commerce and production the report of the British War Cabinet to Parliament states that the question of the "volume and nature of the demand for British goods after the war" and the question of "improvements in trade organization for the purposes of more economical production, distribution and marketing and of facilitating the turnover from peace to war" are being handled in consultation with the British Board of Trade and the Department of Overseas Trade, and that "a comprehensive scheme of work has been prepared." The desire of the government is to leave the industries to ration themselves under certain general principles for which the government must take responsibility.

A Letter Which Explains Itself

Public Utility Companies Are Urged by the Fuel Administration to Store All the Coal Possible if They Would Safeguard Next Winter's Service

UNITED STATES FUEL ADMINISTRATION
WASHINGTON, D. C.

June 1, 1918.

IN YOUR REPLY REFER TO
D-

Mr. William H. Onken, Jr.,
Editor, Electrical World,
New York City, New York.

My dear Sir:

I am sorry that your letter of the 27th ultimo did not get my attention sooner, but I have just returned to the office today for a few hours before leaving for the West.

We find some disposition on the part of public utilities to be rather indifferent in the matter of storing coal because they expect to rely on the Fuel Administration to take care of them throughout the year because of their importance.

As I have already told you, we, here in the Distribution Division of the Fuel Administration, view this disposition on the part of public utilities with distinct concern. If they knew how much difficulty we are having to supply current needs now during the summer time, they would not feel so certain that they would be taken care of next winter. The fact of the matter is, we shall probably find it necessary to insist that many public utilities store coal during the summer and we will make the coal available for that storage. This is the only way in which we can feel certain that we can put them through the winter without serious danger of shut downs.

I am sorry that I have not time to get you up an article on this line, but the foregoing is a brief expression of our sentiments in the matter.

Yours very truly,

UNITED STATES FUEL ADMINISTRATION

By J. D. A. Morrow

JDAM-LH General Director, Distribution

Steel Conductors for Series Circuits

Facts That Determine Choice Between Steel and Copper—A Practical Formula and Its Application to a Particular Case—Most Economical Size of Wire to Use—Other Considerations

BY L. M. KLAUBER

Superintendent Electric Department San Diego Consolidated Gas & Electric Company

ALTHOUGH the use of steel conductors in transmission and distribution circuits has advanced considerably as a result of recent material markets, many companies still hesitate to use the cheaper metal because early experiments in some cases proved failures. Such failures have been both mechanical and electrical. Mechanical failures have occurred owing to rapid corrosion of the conductor or to annealing following short circuits. Most of these cases, however, have been found upon investigation to have involved the use of solid conductors of comparatively small size, such as No. 6 or No. 8 B.W.G., attempts having been made to use conductors similar in mechanical form to the copper superseded. Extra-galvanized stranded steel, on the other hand, has long been extensively used for guys, and its life as a conductor may therefore be closely estimated by any central station, the estimate being based on the performance of guys in the same regions.

Electrical failures have been due to insufficient data on the electrical characteristics of steel conductors, and particularly to lack of consideration of the skin effect in solid conductors, which results in excessive drop at higher current densities. But extensive data on this subject have recently appeared, especially covering the stranded steel largely used in guys, so that the principal uncertainty which now remains has to do with the characteristics of the load, both present and prospective. Obviously, savings through the use of steel result primarily from the fact that in certain classes of lines copper of greater cross-section than is electrically necessary must be used for mechanical reasons. For this reason, an economical steel substitute will have less capacity for increased load than the copper replaced. It is therefore essential in designing steel lines that regulation and losses be closely calculated and that suitable allowances be made for future load increases.

One case in which most of the factors and results may be closely calculated in advance has to do with the use of steel conductors in series street-lighting circuits. In this case current and hours of use are fixed so that losses may be predetermined exactly. Since increased load involves increased pressure per circuit or increase in number of circuits, there is not the possibility of having to replace steel with copper upon acquisition of unexpected new business. Furthermore, there is no possibility of deterioration of the line by annealing during short circuits. If stranded steel guy cable is used, the life may be gaged from previous performances.

FORMULA FOR CHOICE OF CONDUCTOR MATERIAL

It is obvious that the economical choice between steel and copper will depend on a number of factors which are different for each individual case. Of fundamental importance are the costs of the two materials, rates of interest and depreciation and the cost of energy. In general, it may be said that steel will be the cheaper when the annual fixed charges on a copper line are greater than the fixed charges on the steel line plus the increased energy losses by reason of the use of steel plus the fixed charges on the additional constant-current substation apparatus required because of the greater losses in the steel as compared with copper. Stating this in the form of an equation:

$$F_cC_c - F_sC_s - L(HW + F_eC_e) = X.$$

It will be more economical to use steel when X is positive; when X is negative copper is preferable.

In the preceding equation F_c, F_s and F_e represent respectively the rates of interest plus depreciation on copper lines, steel lines and substation equipment. C_c and C_s represent the first cost of unit lengths of copper

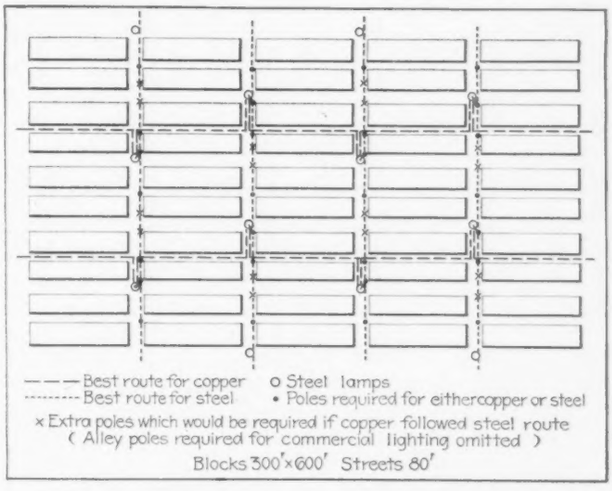

— — — Best route for copper
o Steel lamps
Best route for steel
• Poles required for either copper or steel
× Extra poles which would be required if copper followed steel route
(Alley poles required for commercial lighting omitted)
Blocks 300'×600' Streets 80'

FIG. 1—COMPARATIVE LAYOUTS USING STEEL AND COPPER

and steel lines. This cost must be the cost in place, including overhead expense, since when lines must be removed the total cost in place must be retired from service. C_e represents the first cost of series lighting transformers per kilowatt. L equals the excess loss in kilowatts in a unit length of steel over copper. This quantity evidently depends on the current in the series circuit and the relative resistances of the two conductors at this particular current density, it being remembered that the alternating current resistance of the steel varies with the current density. H represents the annual hours burning in the street-lighting system under consideration. W is the cost of energy per kilowatt-hour delivered at the substation buses; this item should, however, include only those elements of production cost which vary with output (*i.e.*, fuel cost in steam plants).

Were the relative prices of steel and copper to remain in constant ratio with markets fluctuating proportionately, either the one metal or the other would be invariably preferred for certain circuits. This, however, has not been the case, especially under recent ab-

normal conditions, as shown by Fig. 2, which gives the relative costs of steel and copper deduced from the purchasing department records of one central station for the last eight years. It may be seen that the cost of copper wire has varied from about twice to nearly five times the value of steel wire. Under such changing conditions it is logical that sometimes one and sometimes the other metal is more economical.

Application of Formula to a Particular Case

In order to illustrate the application of the above formula, two cases are assumed, one comparing bare copper with bare steel, the other double-braid weatherproof copper with weatherproof steel. The prices assumed should not be considered as indicative of present costs, since they are rather those which applied some months ago:

In giving values to F_c, F_s and F_e interest is taken at 6 per cent. Bare copper is assumed to have a life of thirty years and a junk value of 40 per cent. (In each

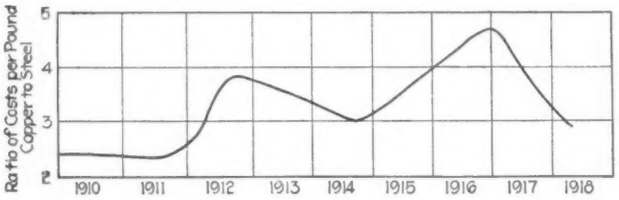


FIG. 2—FLUCTUATIONS IN RATIO BETWEEN COPPER AND STEEL COSTS DURING NINE YEARS

case the junk value represents the sale price as junk less cost of removal.) Weatherproof copper is presumed to have a twenty-year life and a 30 per cent junk value, since the serviceable life of an insulated conductor is in reality the life of the covering; for, regardless of the life of the metal, it must be removed when the covering becomes abraded. For this service weatherproof steel may be assigned the same life as copper, although the junk value will be zero. Bare double-galvanized steel under normal conditions (away from salt fogs or corrosive fumes) is assumed to have a life of fifteen years and to be without net salvage value. Constant-current transformers are assigned a life of thirty years and a salvage value of 10 per cent. Basing depreciation calculations on the straight-line method and adding interest at 6 per cent, the following conditions exist:

	Weatherproof	Bare
F_c	0.095	0.080
F_s	0.110	0.1267
F_e	0.090	0.090

Practically all series lines are No. 6 copper, so only this size will be considered. The best steel substitute appears to be ¼-in. (0.63 cm.) extra-galvanized standard steel strand. Assuming copper (weatherproof or bare) at 34 cents per pound (75 cents per kilogram) at the storeroom, bare steel at 8 cents (17.6 cents) and weatherproof steel at 11 cents (24.2 cents), adding 4 cents per pound (8.8 cents per kilogram) as the cost* of stringing and 15 per cent overhead, and considering 1000 ft. (304.8 m.) as the unit of length throughout, with bare copper weighing 79.5 lb. per 1000 ft. (118 kg. per km.), double-braid weatherproof copper 100 lb. (149 kg. per km.), bare steel 125 lb. (185 kg. per km.) and weatherproof steel 155 lb. (230 kg. per km.), the following is true:

	Weatherproof	Bare
C_c	$43.70	$34.74
C_s	26.74	17.25

(C_e is assumed to be $12.50.)

In the determination of L the resistance of copper is taken as 0.395 ohm. Within the comparatively small range of commercial alternating-current series circuits (4 amp. to 7½ amp.) there is little change in the resistance of ¼-in. (0.63-cm.) galvanized steel, the total increase at the higher density being about 3 per cent above the lower. This is less of a variation than that found between individual samples and may therefore be neglected. The 60-cycle alternating-current resistance of ¼ in. (0.63-cm.) extra-galvanized seven-strand standard steel at these densities has been found by various investigators to be from 1.62 ohms to 1.78 ohms per 1000 ft. (5.3 ohms. to 5.8 ohms, per km.). Taking 1.70 as an average, and assuming a 6.6-amp. series circuit, $L = 0.0568$, H may be taken as 4000 for all-night lighting circuits, 2600 for moonlight and 2200 for midnight circuits. W obviously differs for each individual case and is here taken at $0.005.

Substituting the preceding values in the equation, the following values of X are obtained:

Circuit	Weatherproof	Bare
All-night	0.01	— 0.61
Moonlight	0.41	— 0.21
Midnight	0.52	— 0.10

Thus in each assumed case it will be found more economical to use weatherproof steel rather than weatherproof copper, but bare copper (if line and ordinance conditions permit the use of uncovered conductors) is to be preferred to bare steel.

Assuming the same constants but a 4-amp. circuit, $L = 0.0209$; therefore it will pay to use steel in every instance.

Most Economical Size of Wire to Use

Of the various sizes of standard steel strand, ¼-in. (0.63 cm.) will usually be found preferable for series circuits. Smaller sizes lack strength and are not so readily obtainable as the sizes used for guys. Although largely used in multiple circuits where steel is employed, 5/16-in. (7.9-mm.) cable will generally be less economical than ¼ in. in series circuits. This can be shown as follows: Consider 5/16-in. bare steel weighing 210 lb. per 1000 (312 kg. per km.) and double-braid weatherproof weighing 255 lb. (378 kg. per km.). By substituting the same unit prices and depreciation rates as were assumed in the case of ¼-in. cable, omitting fixed charges on substation equipment, as they are of minor importance, and assuming that the alternating-current resistance of 5/16 in. (7.9-mm.) standard strand is 1.25 ohms per 1000 ft. (4.1 ohms per km.) at the current densities under consideration, the original equation reduces to:

$$1.486 - 0.45I^2HW = X \text{ for bare}$$

and $1.898 - 0.45I^2HW = X$ for weatherproof.

Thus for 6.6-amp. series circuits it will be more economical to use 5/16-in. (7.9-mm.) strand than ¼-in. (0.63 cm.) cable only when the cost of energy per kilowatt-hour at the substation exceeds the following:

	Weatherproof	Bare
All-night	$0.024	$0.019
Moonlight	0.037	0.029
Midnight	0.044	0.035

*There is practically no difference in the cost of erecting copper and steel.

It may therefore be seen that ¼-in. strand is to be preferred in all ordinary cases.

OTHER CONSIDERATIONS THAT AFFECT CHOICE

Of course, in a problem of this nature, involving a choice between copper and steel, or between two sizes of steel, the mere balancing of reduced fixed charges against increased operating expenses is not always the sole controlling factor. Where work is of a temporary character, as for camp or protective lighting, the element of depreciation which operates so strongly in favor of copper is more nearly equal for the two metals, and steel is usually to be preferred. Again, there are occasions when difficulty in raising funds renders desirable a reduced cost of installation, even at the expense of slightly increased operating expenses over a term of years.

There are other cases in which considerable savings may be made in first cost, owing to the increased tensile strength of the steel permitting wider pole spacings. An example of such a case is shown in Fig. 1. It is assumed that blocks are 300 ft. by 600 ft. (91 m. by 183 m.), with 80-ft. (24-m.) streets, and that commercial lighting feeders and mains are run in the alleys. The most economical system of covering the territory with steel takes only about 62 per cent as much line as the copper method shown. Besides, the construction is much simplified at corners and many dead ends and anchors are eliminated. The route outlined for the steel circuit is impossible with copper unless extra poles be added as indicated. This would considerably increase the cost and would be undesirable from a public-policy viewpoint, as it is preferable to have poles only on street corners where they carry street lamps.

On the other hand, with steel conductors it is perfectly feasible and safe to jump 380 ft. (116 m.) from alley to alley in the blocks where street lamps are missing, thus permitting the simplified system of passing back and forth on cross streets.

Stock Worth $8,203,000 Sold Locally

Pacific Gas & Electric Company's Plan Interested More than 40 per Cent of Employees, and by Means of It 6663 New Stockholders Were Added to the Number Already on the Books of the Public Utility

WITH the increasing difficulty in raising money by public utilities, the plan of selling securities locally is appealing more than ever to utility operators. Generally speaking, money is cheaper and easier in local markets than in the large financial centers. Not many electric utilities have made an effort to place their securities locally. One of the pioneers in this line of activity is the Pacific Gas & Electric Company of San Francisco.

In June, 1914, this company undertook to market an issue of $12,500,000 of first preferred 6 per cent stock. The method of doing this was so successful that by the close of 1915 not only had the entire issue been sold but permission was obtained for issuing an additional $2,500,000 as might be needed, thus bringing the total issue up to $15,000,000. Up to the early part of 1917 $14,553,000 had been sold, without any underwriting, out of the total issue, of which more than 50 per cent had been sold to employees, consumers and others living in territory served.

The greatest attention to the stock-selling campaign was given in the latter part of 1914. Concentration on sales work was less in 1915 and 1916, and during the past year no sales effort whatever has been put forward. However, subscriptions are now coming in constantly without solicitation. In recent months these have been totaling $25,000 to $30,000 per month. The company believes that it is good policy to sell stock to consumers, and even though no sales effort is being made, stock will always be kept on hand to meet unsolicited applications.

The tables show how the sales were distributed over the two and one-half years of activity. The sales by months in 1917 reflect the high degree of prosperity that manifested itself in January and how the investment in stocks suddenly dropped off after our entry into the European war. It will be noted in the table summarizing stock sales for the four years that the average investment of each purchaser is $1,231. The total of 6663 purchasers includes about 1750 employees, or 40 per cent of the total number, and includes very few people not served by the company either directly or indirectly.

Since this stock-selling plan was inaugurated the par value of the outstanding stock has increased 40 per cent and the number of stockholders 177 per cent, which is considered a striking illustration of what can be accomplished by distributing the stock in small amounts among a large number of investors.

In describing the methods followed in selling this stock to consumers and employees, A. F. Hockenbeamer, vice-president and treasurer of the company, who originated the plan, has the following to say:

> Under date of June 1, 1914, we issued a circular to all officers and employees of the company. Distribution was effected through our local offices, and these offices also handled the subscriptions. On July 24 we issued a circular to all of our consumers. About 260,000 were mailed in sealed envelopes as first-class matter. The circulars inclosed in envelopes were sent to the local offices where the addresses were placed upon them by means of the addressograph machines used in making out gas and electric bills.
>
> On Aug. 15, 1914, we sent a second circular to practically all consumers, but this time the distribution was effected in each district by means of collectors who delivered the circulars as they covered their routes in the performance of their ordinary duties. In some cases special messengers were employed. With this circular we inclosed a return post card giving the consumer an opportunity to indicate whether or not he had sufficient interest in the offering to justify our sending some one to see him or to send him further information. Very few of the post cards were returned, and this part of the plan was a failure.
>
> Just before mailing the circular to officers and employees we had a meeting in San Francisco attended by all heads

of departments, district managers and all principal employees. At this meeting full information was given and everybody present encouraged to ask questions. A similar meeting was held at the time the first circular to consumers was mailed.

Advertisements, which were changed from time to time, were inserted in the principal San Francisco papers and in practically all of our country papers. In this connection a good deal of excellent publicity was obtained in the news columns of these papers. This latter publicity was along legitimate lines as the plan was a novel one and naturally created a good deal of interest. Our managers and a good many of our employees solicited subscriptions. In addition to these we sent out a few men from the head office, not over five or six at any one time, who worked on a commission basis of $1 per share.

In some of the smaller communities, and in several cities outside of our territory where we had no managers of our own, we made arrangements with local men, usually real estate and insurance brokers, to secure subscriptions on the basis of paying them $1 per share. These local men were supplied with printed cards to place in their windows and on their counters, and we also used similar cards in our own offices.

We established at the head office a "stock sales department" where the details of the campaign were handled. This department prepared and sent out all circulars and advertisements, handled local agencies, the outside solicitors referred to in the foregoing, and took care of correspondence. At first a commission of $1 per share was paid regular brokers, but the results were rather meager, as the stock was not as a rule bought by brokers' clients, and after a few months this commission was withdrawn.

On the back of the first circular to consumers appeared a list of 93 banks, these being the depositaries of the company in the cities and towns in which it operates, which, by special arrangement, act as agents for receiving subscriptions and payments. This proved to be a convenience to subscribers and also resulted in a number of subscriptions being received through the direct efforts of the banks. The most efficient service was rendered by depositaries in San Francisco.

As a rule the country banker was actuated more by the desire to keep his deposits intact than by any wish

TABLE I—FIRST PREFERRED STOCK SALES BY MONTHS

	1915		1916		1917	
	Number of Sales	Par Value Stock Sold	Number of Sales	Par Value Stock Sold	Number of Sales	Par Value Stock Sold
January	262	$307,500	131	$215,700	408	$723,900
February	146	210,800	99	162,500	73	64,100
March	111	241,600	125	422,600	66	81,100
April	176	334,000	35	25,000	94	19,100
May	145	282,100	2	1,300		
June	231	429,300	1	300		
July	145	478,400	1	100		
August	108	100,600	2	1,300	9	1,800
September	94	414,500	25	45,500		
October	177	508,900	59	75,900		
November	79	241,500	39	41,600		
December	38	235,900	98	131,300		
Total	1712	$3,785,100	617	$1,123,100	650	$890,000

to help secure subscriptions. Having this long list of banks on the back of the circular, however, lent distinction to the offering and undoubtedly helped to impress a good many people. With one exception, no compensation was paid to the banks for their services, although they were to be allowed one-tenth of 1 per cent on all payments handled. The money was to remain with them on deposit until needed by the company. Most of the money is still in the country banks.

Newspaper advertising, personal work of local managers and employees and circulars to consumers were the most effective means of making sales. Local agents and outside solicitors accomplished comparatively little. One of the interesting features of the campaign was that most of the stock was bought, apparently, by those unaccustomed to investing in securities. Evi-

TABLE II—SALES OF FIRST PREFERRED STOCK TO EMPLOYEES, CONSUMERS AND OTHERS IN TERRITORY SERVED BY THE COMPANY

	No. of Sales	Par Value Stock Sold
*1914	3684	$2,405,200
1915	1712	3,785,100
1916	617	1,123,100
1917	650	890,000
Total	6663	$8,203,400

*First sales were made in June, 1914.

dences of this were the large percentage of payments made in coin which had evidently been hoarded away.

Mr. Hockenbeamer's conclusions are that at least three conditions must obtain to insure success for a stock-selling campaign of this sort—first, the security offered must be safe and sound beyond question, as it would be suicidal to have anything go wrong with the investment after being widely distributed among customers; second—denominations must be sufficiently small to be within the reach of people of moderate means; third—the yield on the investment must be relatively high, for example, approximately what a good real estate mortgage should return.

Increased Utilities Costs in Oklahoma

The answers to a questionnaire on increased utilities costs sent out to Oklahoma properties show considerable advances in labor, fuel and other materials. The advances in percentages as referred to costs in 1915 were given in a paper read before the convention of the Oklahoma Gas, Electric and Street Railway Association of Oklahoma by Prof. L. W. W. Morrow, director of the School of Electrical Engineering, University of Oklahoma.

Increased labor cost:

	Low	High	Average
Linemen	15	75	50
Engineers	—	70	40
Common labor	20	100	60
Mechanics	17	100	45
Firemen	21	100	51
Office force	—	100	33

Increased fuel cost:

	Low	High	Average
Coal	20	40	25
Oil	100	300	200
Gas	—	100	20

Increased cost of other materials:

	Average
Meters	25
Wire	90
Hardware	70
Lubricating oil	50
Waste	100
Water-treating material	50
Pipe	100

The report shows an increase in operating income, but in every case an increase of operating ratio was reported. Taxation expenses were reported as increased from 3 to 25 per cent.

War Service of the Electrical Manufacturers

How the General War Service Committee of the E'ectrical Manufacturing Industry Has Worked with the Government to Promote the Nation's Interests and Bring Victory Nearer

BY ROBERT K. SHEPPARD

In presenting the report of the general war service committee of the electrical manufacturing industry, of which he is chairman and C. L. Collens II, James C. Hobart, J. R. McKee, William W. Nichols and Charles A. Terry are the other members, to the Hot Springs (Va.) convention of the Electric Power Club, held on May 30 to June 1, Mr. Sheppard spoke in part as follows.

THE organization of the electrical manufacturing industry was begun Nov. 28 last at the first meeting of the general war service committee appointed concurrently by you, the Electrical Manufacturers' Club and the Associated Manufacturers of Electrical Supplies, under resolutions suggested by the Electrical Manufacturers' Council and according to plans formulated in September, 1917, at the war convention of American business under the auspices of the Chamber of Commerce of the United States. Our nation has the right to call for, and her industries have the duty to give her, every unit of energy which will propel her enormous war machine most quickly and effectively against her foes. Devoted men, without hope of other reward than a consciousness of loyal service rendered to their fellow-men, have thrust aside their great interests in civil life to put all their wisdom, all their experience, all their organizing powers at the government's service. You find them in the War Industries Board and its divisions and sections, in the Food and Fuel Administrations; you find them in army and navy uniforms, in the Red Cross, in the Y. M. C. A.; you meet them everywhere. They are doing glorious deeds silently and with infinite patience; they are bearing unknowing, unkind, unfair criticism as silently and stoically. Many of them have tasks for the adequate fulfilment of which they should have ready to their hand the knowledge, the resources, the sympathy of an army of specialists, men in every industry who have learned their particular business from the ground up. We owe them our aid.

ORGANIZED INDUSTRY ANSWERS COUNTRY'S CALL

Organized industry, voluntarily preparing itself for every emergency, enlisting itself in unselfish co-operation, summoning every American manufacturer to service, that is the answer already given to the bugle call for intensive industrial mobilization. The electrical manufacturing industry is one of nearly 150 lines of business to begin that united industrial service. That is why your general war service committee was appointed. Its aim is to gear together the hundreds of big and little wheels known as electrical manufacturers, to get all the wheels into the mechanism, to keep them there and in running order so long as there is any possibility of this particular mechanism being a help to our country in winning the war. That truly is more than one job; it is a combination of big undertakings consuming much time and much labor.

There are a multitude of electrical manufacturers who are not members of either the Electric Power Club or the Associated Manufacturers of Electrical Supplies. The allegiance of that multitude is essential to the fulfilment of your war service committee's duty. Many of those manufacturers have already responded splendidly.

The splendid work which you had done in connecting your branch of our industry with the federal government rendered material assistance to our efforts further to organize the industry. The remarkable service of the wire and cable manufacturers, under the able leadership of Le Roy Clark, gave the federal authorities such a marked example of efficient collective service that equal service in case of shortage of supply would be heartily welcomed at Washington. Under the plan of your committee to organize the rest of the industry into similar groups, such service could be had from any section of the electrical industry.

TWENTY-SIX GROUPS ALREADY FORMED

Already twenty-six such groups have been formed, and several more are in process of organization. Each group has chosen its own committee through which to give its collective service in its special line of manufacture. Groups of manufacturers who hitherto have not found homes in any electrical association, voluntarily applying for places in the organization, have proved to the general committee their eligibility for war service as electrical manufacturers. The groups find their places naturally in two great divisions of the industry, the manufacturers of electrical apparatus and the manufacturers of electrical supplies. In those great divisions staff committees have been organized. They are the connecting links between the general war service committee and the groups. They also serve the dual purpose of co-ordinating the work of the group committees and providing responsible bodies for the discussion of the problems of each large division of the industry in relation to the war needs of the nation.

The wisdom of so organizing the industry has been conclusively demonstrated. Few changes in this form of organization will occur, but its expansion may yet be considerable. This war service organization really amounts to an economic movement, begun under the heavy pressure of an unprecedented need, but destined to benefit our entire industry long after the present demand for its peculiar service has been stilled by the final victory of the Allies.

So useful to the government have been the devotion and unselfish labors of the chairman of the wire and cable committee, whom we mentioned once before in this report, that the recently organized War Industries Board summoned Mr. Clark to be the chief of its newly-created Wire and Cable Section.

Your general committee has consistently urged the war service executive committee of the Chamber of Commerce of the United States to persuade the federal

government to stop the numerous questionnaires which at one time were being sent out from many different bureaus in Washington. Our appeal has met with some success. The War Industries Board has now a central bureau for the collection of statistics.

In the preparation of bulletins your committee sympathizes with the feelings of many executives who are flooded with bulletins on every conceivable subject. Nevertheless, it has seemed best to your entire committee in the last six months to issue six bulletins, making them as concise as possible.

Your committee has considered carefully whether or not it ought to supply the industry with a Washington office, competently manned, for war service. We have consulted many manufacturers who are not now represented there. Group chairmen also have expressed their views. The opinions of them all favor the committee's present plan of administration without a Washington office. Furthermore, this plan is approved by important leaders in war service who are themselves now stationed in Washington, such as the chairman of the war service executive committee of the Chamber of Commerce of the United States. The large cost of having headquarters in Washington would be a waste of financial resources unless and until that agency could be made the repository and disseminating medium for much varied data that have never been possessed by any small group of men in our great industry. For these and other reasons your committee will continue its offices for the present at 50 Church Street, New York City, and put forth its best efforts to strengthen and utilize the services of the group committees.

Much detail of organization had to be completed before the committee could proceed with its most important service to the industry in its relation to government requirements, namely, the compilation of a directory of electrical manufacturers and their products. That directory is now almost ready for publication. In the first part of the book all electrical products are cataloged by classes. To each group was assigned the task of choosing its own classification of the articles in its line and of listing all American manufacturers of those goods as completely as they are known, and provision has been made to add to the list as other makers become known to us. Against each cataloged item are given reference numbers which identify in Part II the manufacturers who make the article. On the same pages with the lists of manufacturers are given the committees appointed by those manufacturers to deal with all government agencies requiring collective service from the groups.

The simplicity and completeness of the scheme is the greatest assurance that it will be used in government departments by the men directly charged with engineering, procurement, inspection and like duties. The directory will enable those men to get quick, direct contact with individual manufacturers, or with all of them, or with the responsible committee who will speak and act for the group collectively.

Compiling the data for the directory has been a big task which could not have been done without the devoted work of the chairmen of group committees, the untiring efforts of W. H. Lanman of New York City and the splendid co-operation which has been freely given in all quarters wherever we have turned for aid.

Applied to an entire industry war service comprises many varied activities. None can speak more vividly of the imperative and unexpected calls from government quarters than can the members of some of our committees. At the least reckoning, our industry's pledge to war service means:

1. That every facility, including plants that never did government work before, shall be used to maintain maximum production of materials essential to winning the war.

2. To supply the needed articles in the quantity, of the quality required and in the time set.

3. To supply them at moderate prices.

4. To provide engineering data, advice and similar help which the experts of industries are best qualified to supply.

5. To suggest changes or temporary abatements in specifications if pre-war standards prevent delivery on time of an adequate supply of the needed articles.

6. To produce essentials at the sacrifice of non-essentials.

7. To remedy existing shortages and prevent impending ones.

8. To aid the authorities in wisely distributing and conserving raw materials, fuel, power and those supplies which have to be imported and are necessarily restricted by shortage of ships.

9. To arrange with the proper authorities so that labor available in our industry may be so distributed as to be most productive.

10. To accept and provide for dilution of labor.

11. To work with those committees of the government which determine priority of production, of fuel distribution and of transportation, to the end that the stream of essential goods may not be impeded.

These and many unforeseen tasks will make up the programs for our committees in the coming months.

The needs for war production of any section of our industry are known best to the men who are actively engaged in it. They know the products, the manufacturing capacities for war service, the available engineering talent, the costs of the goods and numberless details. Those men are on our group committees, and your general war service committee purposes to do all that it can to bring those group committees close to the powers in Washington.

A NEW master has conquered the world, and with weapons so strong and cleaving that he brings every art and industry to harvests not to be imagined a century ago . . . From long before the dawn of history the flame kindler was the commander of human toil, and for ages every stride in civilization but confirmed his supremacy. Yet during the past sixty years that supremacy has ended for good and all, and we see that the flame user but paved the way for bolder feats and deeper insights than were to him possible. Electricity to-day does all that fire ever did, does it better, and then accomplishes tasks infinitely beyond the scope of fire, however skillfully applied.—*George Iles.*

Development of Electric Searchlamps

The Newest Principle of Operation Consists of Rotating Small-Diameter Cored Electrodes Subject to Increased Arc Voltage in Order to Give a Highly Concentrated and Intense Crater

BY LOUIS J. AUERBACHER

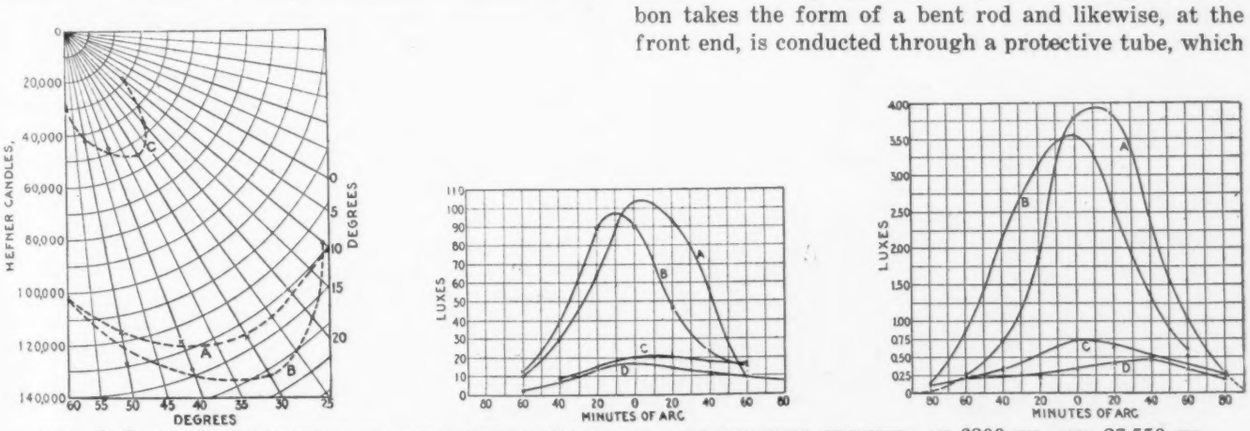
ONE of the first uses made of the electric arc light discovered by Davy in 1802 was its application as the luminous source of searchlamps. For such apparatus particularly the discovery of the electric arc signified an enormous step forward. Not only a source of high luminosity was required here, but also, and even more, a high specific intrinsic brilliancy. Therefore the luminous source had to be restricted as much as possible, in spite of its high luminosity, to a minimum surface. This requirement was best met by the arc, whose main source of illumination is the crater.

In the course of the development the arrangement of this luminous source was subjected to many changes. In the first and earliest searchlights the carbons were arranged one above the other, vertical to the optical axis of the reflector or lens. Subsequently they were arranged obliquely to the optical axis, in order to obtain a better radiation of the light from the positive crater. Then the system was adopted of placing the carbons in line with the reflector axis. In this manner probably the most symmetrical radiation of the light upon the reflector is secured. At times the negative carbon in this system was placed at a right angle to the positive carbon, or at an acute or obtuse angle. By this means it was desired to avoid as far as possible the formation of shadows by the negative carbon. It was difficult, with the horizontal lamp, to maintain the crater constantly in a uniform, rectangular position to the optical axis. Consequently directive magnets were employed or the positive carbon was made to rotate slowly or rapidly around its axis. Arrangements are also employed in which the carbons, especially the positive carbon, can be adjusted to the proper position while burning without opening the searchlight casing in order to bring the crater into the right position.

When, in the course of time, constantly higher currents were used and the requirements became more and more stringent in regard to the steadiness of the light, it was soon recognized that the frequent disturbances were mostly caused by the negative carbon. Various attempts were made to remedy this condition. First of all, it was found advantageous to use a negative carbon of an essentially smaller diameter than that of the positive electrode. In this connection reference should be made to the German imperial patent No. 185,216 (1906), Gebr. Siemens & Company, Charlottenburg. According to this patent, a thin carbon rod is surrounded at a certain distance from its burning end by a tube in such a manner that the rod can be easily moved or rotated therein. The tube serves to decrease the resistance in the electrode, besides serving to protect the thin carbon rod from combustion. This arrangement of the electrode is said to give very favorable results, as the thin carbon rod always burns away in the form of a slender point. From this slender point the arc is thrown out in the form of a rather thin ray in the direction of the axis of the rod, its position being stationary. Therefore the crater of the positive carbon is very uniform and the light, it is claimed, is steadier. Furthermore, the slender electrode point does not impede the radiation from the positive crater to any great extent.

The scheme outlined requires the use of comparatively long negative carbon rods which cannot always be arranged conveniently in the space between the reflector and the luminous source. According to the German imperial patent No. 203,549 (1908), Gebr. Siemens & Company, therefore, the thin negative carbon takes the form of a bent rod and likewise, at the front end, is conducted through a protective tube, which prevents the combustion of the rod and decreases its resistance. This protective tube may be provided at the end nearest the arc with a protective cap of refractory material. According to this patent, the electrode holder through which the carbon is conducted is cooled from its interior by the application of liquids or gases (air or any other gas desired).

The idea of using as thin negative electrodes as pos-



FIGS. 1, 2 AND 3—COMPARISON OF CANDLEPOWER CURVES, AND ILLUMINATION PRODUCED AT 6800 FT. AND 27,550 FT. BY BECK LAMP

Curves A and B refer to the Beck lamp, while C and D refer to old-type searchlamps. The readings for curves A and C were taken in one plane and those for B and D in a plane at right angles thereto.

sible for the same purposes is also found in the German imperial patent No. 255,314 (1910) of Heinrich Beck. However, in this patent the disadvantages of the heavy protective tube which produces disturbing shadows and is very susceptible to destructability are eliminated. According to this patent, gases or vapors are directed to the burning end of the thin negative carbon, thus impeding the quick combustion of the negative carbon. As the gases employed are usually good conductors of heat, the desirable cooling-off of this electrode is obtained. This enveloping by gas constitutes a sort of economizer, which, however, is transparent and consequently does not impede the radiation of light from the positive crater against the reflector.

It was found advantageous to permit the point proper of the negative carbon to protrude through the gas envelope. The negative electrode is provided with a core composed of material more refractory than the carbon shell, to assure a slender burning end and thus minimize the formation of shadows by the negative electrode.

Another development in which it was also the object to use thin negative carbons is embodied in the German imperial patent No. 210,251, Gebr. Siemens & Company. The negative carbon is provided with a metal coat which melts off before it arrives in the neighborhood of the arc.

While all the patents referred to deal with the improvement of the negative electrode of the ordinary arc, we find in the German imperial patent 215,177 (1908), Gebr. Siemens & Company, an arrangement aiming at the improvement of the positive electrode in the ordinary pure-carbon arc. In this arc the positive electrode, as is well known, tapers toward the crater and the entire end of the electrode is at a high degree of incandescence. The highly incandescent conical carbon end, which is mainly heated indirectly by means of the transformation of energy in the crater, radiates a part of the added (conducted) electric energy into heat and therefore decreases the efficiency of the arc. This loss is minimized by making the diameter of the positive electrode as small as possible. Thus the crater which remains smaller than the carbon exposes relatively less surface than in other arcs and radiates less heat, it is said. In order to protect the carbon rod against premature destruction, it is incased in a protective tube, as described in patent No. 185,216.

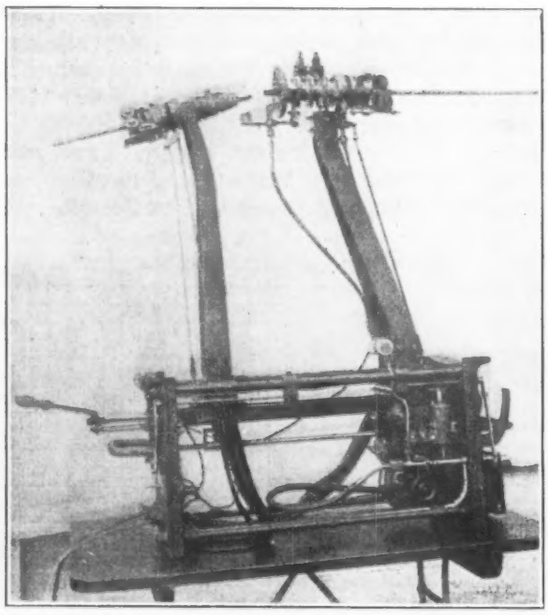


FIG. 4—ELECTRODE HOLDERS AND OPERATING MECHANISM OF BECK LAMP

Summarizing all the arrangements described, from the first application of the Davy arc to the latest and most perfected models, it may be noted that after the initial application practically no change was made in the fundamental principle of the generation of light. The quality of the carbons was constantly improved upon, but it can hardly be said that that any essential improvement was made in the specific brilliancy which was obtained in the first searchlight-lamp models. The chief progress has been in increasing the current per lamp and in obtaining at the same time a steady light from the crater. Increase of the current alone, which also has its limit, failed to produce any more luminous searchlights, as the specific brilliancy is not materially affected thereby. In order to obtain a higher luminosity, larger reflectors have to be used, but there is a practical limit to their dimensions.

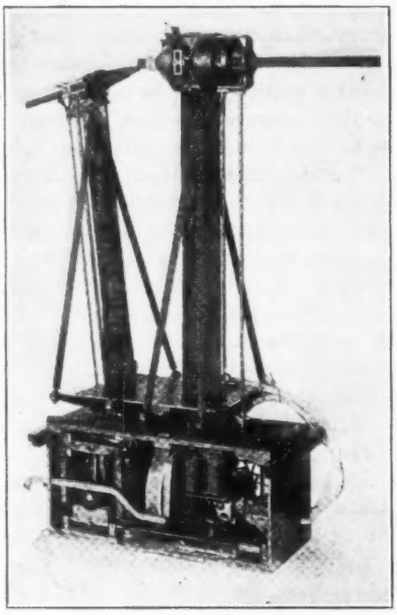


FIG. 5—MECHANISM AND ELECTRODE HOLDERS OF SPERRY LAMP

Thus a temporary condition was changed when Heinrich Beck of Meiningen succeeded by the use of a cored carbon for the positive electrode in producing a novel arc which had hitherto been entirely unknown. In this arc the specific brilliancy of the crater has been increased to such an extent that it is possible to construct searchlight lamps which excel their predecessors in luminosity by 300 per cent and more.

The use of impregnated carbons for searchlights was described before Beck's development in the German imperial patent No. 136,095 (1901), Hugo Bremer, where its disadvantages were also outlined. The light emanates chiefly from the voluminous flame which is produced with such carbons. The total luminosity is great, to be sure, but the specific brilliancy which is the essential thing is not high, since the luminous surface is too large. To avoid this objection Bremer tried to compress the arc mechanically by means of an air current, but it is doubtful whether he was successful.

Beck found that a novel arc is obtained if the positive carbon containing luminous substances is made very thin and required to carry a large current. The diameter of the carbon is smaller than the crater of the pure carbon arc. The arc thus obtained is characterized

by the deep funnel-shape crater, which is filled with luminous vapors of very high specific brilliancy; by positive and negative flames, which are both visible; by the relatively small illuminating power of the flame between the electrodes compared with the luminosity of the crater, and by the high arc voltage, which is approximately 73 volts.

In the United States patent No. 1,086,311 and the German imperial patent No. 274,110 (1912), Beck says

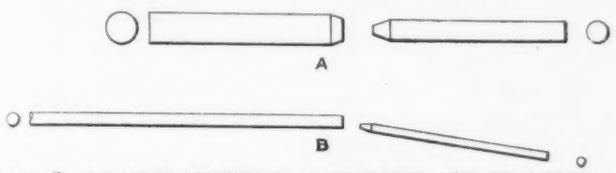


FIG. 6—RELATIVE DIAMETERS OF STANDARD AND BECK ELECTRODES FOR SAME CURRENT RATING (150 AMP.)

that by the use of highly loaded flame-arc carbons two arc conditions are possible for the same current and separation of the electrodes. In the one condition the crater is flat and the voltage amounts to about 43 volts. In the other condition, with the same separation of electrodes, the voltage is about 73 volts and the crater assumes a very deep funnel shape. Beck points out further that the negative and positive flames act reciprocally on each other, the position of the former being an important factor in the establishment of this novel arc. To influence the position of the negative flame very highly loaded flame-arc carbons are used and the negative carbon is placed at an angle with the positive electrode.

According to the German imperial patent No. 262,913 (1910) or the United States patent No. 1,029,787 (1912), Beck cools the electrodes by a current of gas which protects the carbons from premature combustion and prevents injurious leakage of the current from the shell, thus permitting the maximum concentration of current in the crater. By the concentration of current and reduction in radiation due to the deeply hollowed crater an extremely intense heat is obtained in the crater. In this way the vapors in the hollow of the crater are made to emit the maximum amount of light, which in conjunction with the white incandescence of the crater gives an exceptionally strong illuminating action. The negative carbon may be a pure carbon, however. Patent No. 262,913 mentions metallic salted carbons for this purpose, too.

According to descriptions* of the Beck lamp, the positive carbon, arranged in the axis of the reflector, rotates and is guided in a holder provided with ribs for cooling purposes. This holder is stationary and the carbon slides through it, the feed being controlled by a thermostat placed so that the light or heat from the arc is radiated on it only when the crater is at the focal point of the reflector. If the crater shifts out of its correct position, the thermostat closes contacts, thereby putting and keeping the feeding mechanism in operation until the proper position of the crater has again been obtained. The negative carbon is also held in a holder similarly to the positive carbon, arranged at a slight angle to the positive carbon. The burning ends of the carbons and the inclosing shell were cooled in the lamp described by McDowell by hydrocarbon vapor.

*ELECTRICAL WORLD, July 25, 1914; *Elektrotechnische Zeitschrift*, Aug. 6, 1914, and a treatise by C. S. McDowell in the *Proceedings A. I. E. E.*, February, 1915.

According to McDowell, the luminous power of the 44-in. (111.76-cm.) Beck searchlight is about five times greater than the luminous power of the 36-in. (91.44-cm.) standard searchlight and about two and one-half times greater than the 60-in. (152.4-cm.) standard searchlight with pure carbon arc. According to Mr. Wedding, the luminosity of the 110-cm. Beck searchlight at 150 amp. amounts to about 500,000,000 cp.

The searchlamp† developed by Elmer A. Sperry is not very unlike the Beck lamp in its distinguishing features. From an article describing the Sperry lamp it appears that the same electrode dimensions are used as in the Beck lamp, but in the Sperry lamp the carbons burn off more quickly, *i.e.*, 13.5 in. (343 mm.) per minute. In comparison therewith the positive carbon consumption taking place in the Beck lamp when the carbon shell at the tip is cooled by gas is 200 mm. to 240 mm. per hour. Mr. Beck provides for greater carbon consumption (400 mm. per minute) in United States patent No. 1,086,311.

The voltage employed across the Sperry lamp is also about 70 volts, and forced cooling of the electrode holder is employed. This arrangement has also been described in patent No. 203,549 by Gebr. Siemens & Company, as mentioned before. Beck used cooling ribs on his holders. The arrangement of the carbons and the rotary feeding of them are also similar in the Beck and Sperry lamps, likewise the automatic holding in focus of the crater with the aid of a thermostat.

The functions performed by air cooling in the Sperry arc and by the improperly termed gas (alcohol) cooling in the Beck lamp are totally different. In the first the process merely cools the holders, whereas in the second the alcohol flame exerts a direct influence on the arc, confining the light-giving source and thereby reducing wide dispersions of rays.

In the latest patent literature on searchlamps we find United States patent No. 221,917 applied for by Elmer A. Sperry on June 28, 1915, "Method of Operating Flaming-Arc Lights for Projectors." In the opinion of the author, this patent offers nothing new, since from

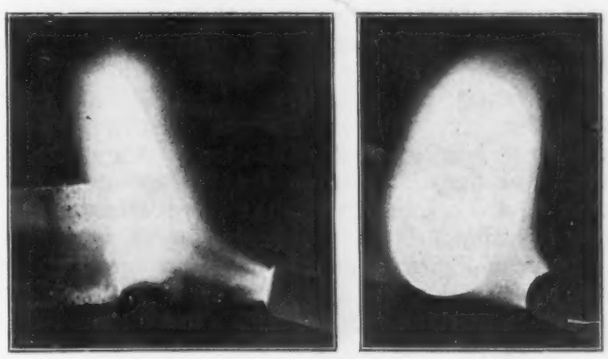


FIG. 7—TWO-FLAME ARC FROM BECK LAMP

the Beck patents we know that a positive flame and a negative flame are obtained and that the negative flame emanates from the negative carbon with great velocity. We also know that a reciprocal action of these two flames exists in such a way that there is, so to speak, a pressure. The inclined arrangement of the negative carbon, as well as the use of cores for the negative carbon with "arc-supporting material," are also known.

†Described in the ELECTRICAL WORLD of Sept. 25, 1916.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

AN INEXPENSIVE METHOD OF GROUNDING TO WATER MAINS

Company Which Owns Both Light and Water Utilities Makes Grounding Provisions While Laying Water Pipes

A company in the Northwest which owns both the electric and the water plant in a small city has worked out a scheme of grounding to water mains which it considers better than the method of grounding to a brass plug. When the water mains were being laid, pieces of bare No. 4 copper wire were carefully tinned and sweated into the lead which was used to form the joints between the sections of pipes. One end of the wire was left protruding to afford an easy connection. The ground leads connected to these protruding wires thus are tapped directly into the joints of the water piping. Engineers who discussed the feasibility of the plan before it was attempted felt certain no trouble could result from it. The possibility of the ground wire carrying enough energy to melt the lead in the pipe joint was remote.

BEARING PITTING IN MOTOR-GENERATOR SETS

Two Engineers Differ on Theory of Cause of Trouble but Give the Same Method of Overcoming the Difficulty

Grounds and weak insulation are given as the cause of bearing pitting* by P. A. Borden of the engineering department, Hydro-Electric Power Commission of Ontario, whereas an engineer in a Southern town claims that eddy currrents are set up in the iron of the armature structure by short-circuited or otherwise damaged laminations. The latter engineer thinks that if leakage current is the cause it would burn out the coils in a short time. Both of the men say that the best way to remove the trouble is to insert thin sheets of insulating material between the bearing shells and their housings in order that the stray-current circuit may be broken.

Referring to a previous experience, Mr. Borden states that in one case a brush placed on one end of the shaft to reduce sparking on the journals and oil rings fulfilled its service at that end but greatly increased the sparking of the other journal. With a brush placed at each end, the current was so great that the brushes were heated to a prohibitive temperature. Further experiments showed that this current gave readings of several hundred amperes when measured either with a shunted D'Arsonval type meter or with an induction-type instrument through a series transformer. Oscillograph records indicated the current to be a mixture of undirectional and alternating current, the latter having a periodicity of 60 cycles per second.

*See also ELECTRICAL WORLD, April 13, 1918, p. 778.

In this case the trouble could not have been due to leakage because the machines were operating at a lower frequency than 60 cycles. It was thought that the small electromotive forces responsible for these currents were generated in the shaft and other rotating parts by homopolar induction. The source of reversals was assumed to be an alternating field caused by the changing relative positions of the armature poles and the pole pieces. The generator was an eight-pole machine running at 300 r.p.m., and the armature spider had six spokes. Assuming two spokes to be in line with two north poles, the leakage flux would pass in through those spokes and flow along the shaft toward the bearings, electromotive forces being generated by homopolar induction at these points where the flux had a component perpendicular to the axis of rotation. It may be seen that with an advance of 15 deg. the leakage flux would be reversed by two spokes coming beneath south poles. There would thus be a leakage flux, reversing its direction every 15 deg. of rotation of the armature—that is twenty-four times per revolution, or 7200 times per minute. This flux both by generator and by transformer action would therefore be responsible for 60-cycle potentials.

Insulated sheets were inserted between the bearing shells and their housings to remedy the trouble, and it has not recurred during the seven years which have since elapsed.

COMPACT ROOF ARBOR FOR OUTGOING 2300-VOLT LINES

Large Number of Outgoing Circuits Arranged for Easy Inspection and Maintenance—Tension of Individual Circuits May Be Varied

An unusually well-arranged roof structure for outgoing 2300-volt lines has recently been erected at the Daniel Street station of the Rockingham County Light & Power Company, Portsmouth, N. H. This plant is being remodeled by the Harry M. Hope Engineering Company, Boston, and an important part of the work is the rearrangement of the wiring. An electrical bay on the south side of the station is being altered to carry an extended oil switch and bus structure installation. This bay is only about 12 ft. (3.7 m.) wide, and on account of its proximity to the street could not be extended. The equipment, however, is arranged so that the various circuits can be reached with the utmost ease and safety and without confusion as to their identity.

From the bus and switch structure the outgoing lines are carried in conduit across the bay in floor ducts and thence upward along the face of the wall to distributing centers, from which leads are run to sets of Thoner & Martens disconnecting switches installed in a long bank about 11 ft. (3.35 m.) above the floor. From each switch group the leads are carried through vertical con-

duit lines to condulets at the roof level. Extending above the roof level and protected against the effects of the weather by tile and concrete housing is a steel structure consisting of 8-in. channel inclined sections which carry the dead-ended lines of Fig. 2. These lines are arranged in six horizontal and six vertical groups and are connected to the leads in the condulets by triple-

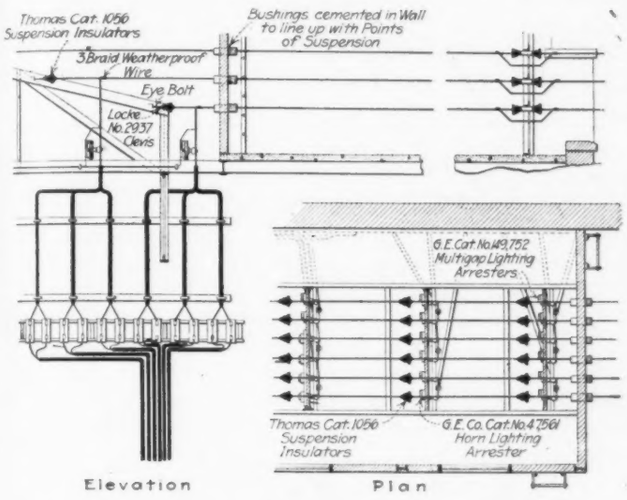

Thomas Cat. 1056 Suspension Insulators
Bushings cemented in Wall to line up with Points of Suspension
3 Braid Weatherproof Wire
Eye Bolt
Locke No. 2937 Clevis
G.E. Cat No. 49752 Multigap Lightning Arresters
Thomas Cat. 1056 Suspension Insulators
G.E. Co. Cat. No. 47561 Horn Lighting Arrester
Elevation
Plan

FIG. 1—SCHEMATIC ARRANGEMENT OF WIRING BETWEEN DISCONNECTING SWITCHES AND OUTGOING CIRCUITS

braid weatherproof wire. General Electric Company multigap lightning arresters are mounted in six horizontal groups of six each, slightly above the level of the condulets, and short taps from the outgoing phase wires are connected to the arrester terminals. Locke insulators with wooden pin tops are used to support the weatherproof risers below the lightning-arrester taps,

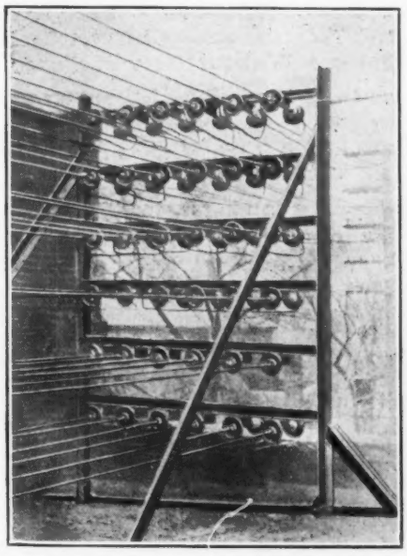


FIG. 2—ROOF TERMINAL STRUCTURE FOR OUTGOING CIRCUITS

and a No. 3/0 B. & S. gage insulated wire is carried as a common return to earth from the arrester sets.

The thirty-six wires forming the outgoing circuits are run horizontally from the wire arbor through Thomas corrugated-wall bushings set into the brick wall of the arbor house and thence to Thomas suspension insulators mounted on the steel framework outside the house on the roof, as shown in Fig. 2.

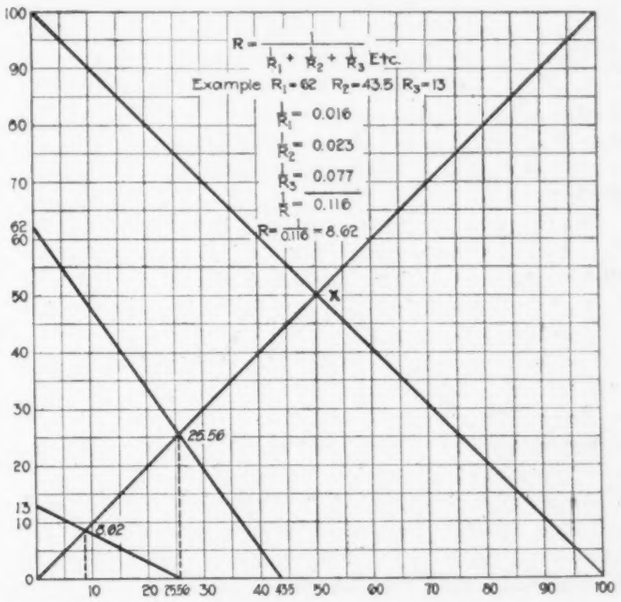
Between each row of horizontal wires the vertical distance is 18 in. (45 cm.), but as the steel framing slopes from rear to front, a free working space is allowed at the taps to each group of outgoing conductors. An operator can vary the tension in any outgoing circuit without interfering with the others. The horizontal spacing between adjacent wires is 12 in. (30 cm.), and the interior of the arbor is very accessible, thus allowing easy maintenance.

RESISTANCES IN PARALLEL DETERMINED GRAPHICALLY*

Simple and Fairly Accurate Method for Finding Resistance of Network Without Detailed Calculation—Accuracy Depends on Size of Chart

BY A. S. L. BARNES

Calculation of resistances in parallel entails a considerable amount of routine work which can be eliminated by means of the graphical system shown here.



ANY NUMBER OF RESISTANCES IN PARALLEL CAN BE DETERMINED WITH A STRAIGHT EDGE AND THIS CHART

This gives a simple method whose accuracy is directly proportional to the size of chart used.

As shown in the accompanying diagram, ordinate and abscissa scales are marked identically on cross-section paper, and a line is drawn from the common zero point at an angle of 45 deg.

If it be assumed that three resistances in parallel are 62, 43.5 and 13 ohms respectively, the ease of determining their total resistance is seen by reference to the chart. The resistance R_1 is measured on the ordinate scale and resistance R_2 on the abscissa scale, or vice versa. These line joining the scale points representing these values will cut the line OX at a point which, projected on either scale, will give their joint resistance in parallel. This new value, 25.56 ohms, if joined to a

*The writer forbears claiming any priority of discovery for this method, though inquiry among several other engineers has revealed no knowledge on their part of the method in just this extremely simple form. Reference to available handbooks, technical magazines, etc., has likewise been fruitless in this respect. On this account the method seemed to be worthy of publication even at the risk of a possible charge of plagiarism.

point on the opposite scale representing R_3, will give a new value, 8.62 ohms, which represents the combined resistance of the three circuits in parallel. This scheme can be extended to include any number of resistances in parallel.

CALCULATING THE LIFE OF INCANDESCENT LAMPS

Obtaining Number of Hours Lamps Are in Service by Use of Formula Applicable to Systems in a Stable Condition

BY H. A. SNOW

Engineer Detroit Edison Company

The determination of life of incandescent lamps by the method of noting the time at which the lamps are lighted and keeping a continuous record is cumbersome and not practicable except for laboratory experiments. If a system has reached a stable condition, the average-lamp life may be calculated provided that complete records have been kept. These records should contain the number of kilowatt-hours supplied to the system in any given space of time, the number of lamp burn outs which are replaced during this space of time and the average rating per lamp in kilowatts of all the lamps in service on the system. The formula for finding the lamp life will then be: Lamp life (hours) = kilowatt-hours supplied ÷ (number of burn-outs × average kw. per lamp).

The accuracy of this formula can be proved from the fact that in a system that has reached a state of equilibrium the average lamp life equals the total number of lamps burning multiplied by the hours burning divided by number of burn-outs.

The first formula is obtained by multiplying the numerator and denominator by the average kilowatts per lamp. The numerator will be: Total lamps burning × hours burning × average kw., which is equal to the total number of kilowatt-hours supplied.

The equation is applicable to any lighting system and may be applied to the entire lighting load of a central station. If the lamp life is known, any one of the other three factors could be determined.

A WAR-TIME EXPEDIENT FOR SUPPLYING SERVICE

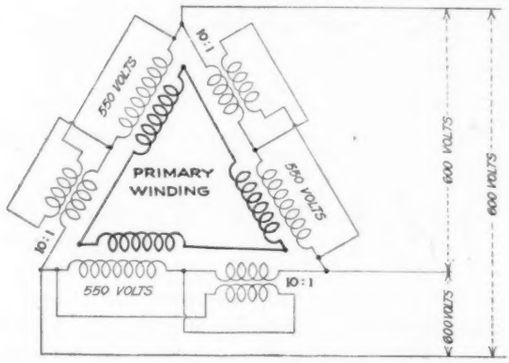
Standard Distribution Transformers Connected Inside Delta Transformer Bank to Serve as Boosters Where Proper Units Were Not Available

BY J. R. BALDWIN

Being called upon to serve a customer having 600-volt apparatus and having only 550-volt transformers without taps for the service, a Southern power company employed the following scheme to get the higher voltage: Three 50-kva., 1100/110-volt distribution transformers were connected so that the low-voltage windings were in series with each of the 550-volt transformers, the high voltage (1100-volt) windings being connected across the 550-volt terminals of the large transformers. The connections are shown in the diagram reproduced.

By connecting the distribution transformers directly across the secondaries of the larger transformers as shown, the boosting voltage was brought in phase with the large transformer voltage and added directly to it.

The current in the delta is not so large as the line current, being equal to the line current divided by 1.73, and hence smaller transformers were used than could have been used if they had been connected



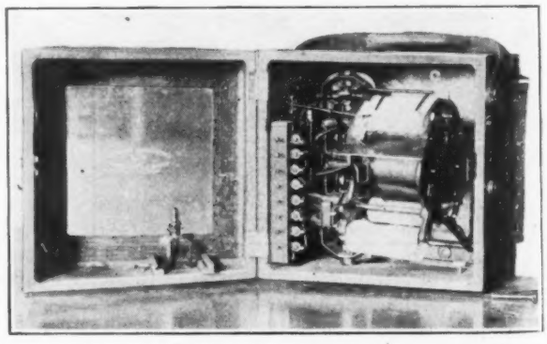
SUPPLYING 600 VOLTS FROM 550-VOLT TRANSFORMERS MADE NEW EQUIPMENT UNNECESSARY

in the lines. No fuses were connected in the high-voltage sides of the distribution transformers as the voltage on these windings would reach an excessively high value if open-circuited, the action being similar to an open-circuited current transformer. This installation has given excellent service for a period lasting more than six months.

INCREASING ACCESSIBILITY OF CURVE-DRAWING METERS

Meter Case Sawed Diagonally Facilitates Maintenance and Adjustments—Chart Roll Can Be Replaced Without Loss of Time

To increase the accessibility of the interior mechanism of a curve-drawing meter used by the Cumberland County Power & Light Company, Portland, Me., the meter case was sawed diagonally into two parts as shown in the illustration presented herewith. When the case is opened on a bias, the clock mechanism and paper carrier project enough to bring them within easy



ROLLS CAN BE QUICKLY REPLACED DURING A TEST

reach for repairing, ink-well refilling, etc. When a test is in progress the roll can be quickly replaced. The instrument was orginally fitted with a hinged cover and considerable time was wasted in reaching the mechanism.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

CLASSIFICATION OF SALES DEPARTMENT EXPENSES

Records of Eastern Company Show that Profit of Department Is Covering All Expenses and Leaving a Satisfactory Margin

With the increasing effort on the part of central stations to eliminate the waste in the routine of administration and develop sales department work to a point where it will be self-supporting, the question of expense classifications becomes important. The following figures from an Eastern central station are therefore interesting. This company maintains a sales department under which it operates a very complete electric shop. It also is very active in the sale of electric motors through its power engineers. In 1917 the total selling expense amounted to $78,049.24, which was classified under the following heads:

	Per Cent
Salesmen's salaries	42
Salesmen's expenses	3
Stationery and printing	1
Postage	1
Telephones and telegrams	4
Rent	3
Miscellaneous supplies and expenses	3
Electric shop expense	29
Main office and three branch offices	5
Newspaper advertising	3
Miscellaneous advertising	1
Promotion work	5
Total	100

The gross profit on the sale of merchandise by this organization last year amounted to $58,822.53, not including motors. This means that the sale of merchandising alone is already carrying 75 per cent of the entire sales department. In 1916 these sales covered 50 per cent. By including the profits of the power department the entire expenses of the selling function were covered last year, however, with a very satisfactory profit.

THE PUBLIC AS PROTECTOR OF LABOR AND CAPITAL

Pacific Coast Company Undertakes Educational Work to Show Citizens Their Relation to the Public Utility

In an effort to educate the public to the relation that exists between the people, the city and the utility, the Puget Sound Traction, Light & Power Company of Seattle, Wash., has been running occasional paragraphs in *The Electrogram*, the bulletin which the company distributes to the public. The latest, entitled, "Public Must Protect Employees and Investors," follows:

The public has a right to expect from a utility the best service possible at the lowest cost possible under the most efficient management, taking into consideration, of course, the conditions and cost elements involved; but the public loses sight of its own interests if it fails to recognize the rights of the utility's employees and of the investors whose money has made the existence and operation of the utility possible.

The public needs the service, and in response to that need the utility came into existence. It was created to furnish the service the public requires. That at once created a community of interest between the public and the utility, and that interest is a fixed factor in community development. It was necessary first to find investors to construct the utility and workers to operate it. The operation is essentially for the benefit of the public.

The employee has a right to wages that will conform to the value of the service rendered—not to the company, but to the community. He is entitled to fair treatment and to a fair attitude on the part of the public toward the utility in which he is interested as a worker.

The investor is the real foundation stone of the organization. Without him there could be no utility, and without the utility the public would be without service, which would force the community to stagnate and to cease to expand and develop.

So when the public compels the investor to suffer by treating him as if he were an outsider not entitled to consideration it loses sight of its own interests.

No community can afford to destroy the confidence of investors in its fairness and integrity.

COMPANY'S EXPERIENCE WITH EMPLOYEE LOAN FUND

Amount of $200 Laid Aside for the Emergency Use of Employees in Sums Which Range from $10 to $50

Some time ago the New Bedford (Mass.) Gas & Edison Light Company instituted a loan fund for the assistance of employees who might be in need of a little extra money to meet emergencies. The fund consists of the sum of $200, which has been laid aside by the executive committee to be loaned to employees who on account of illness or for some other good reason have got behind in the payment of their regular expenses. The money is issued in sums of from $10 to $50 upon receipts signed by the employee, with the understanding that from one to two dollars a week will be taken out of his weekly pay to reimburse the company for the money advanced. No interest is charged.

The receipt is given to the employee after the full amount has been restored. In commenting on the working out of this idea, Charles R. Price, treasurer of the company, gives these interesting details:

We have had several occasions calling for the use of this fund. While it was started to help in particular emergencies, we have applied it for some half dozen of our employees. Our first case was one of the line gang who had been injured and, while his pay through the insurance and this company was kept up to the full amount, his wife was obliged to go to the hospital to await the expected baby and the three young children at home had to have a housekeeper to look after their daily wants. These expenses were beyond the daily receipts of the employee and the allowance afforded was very welcome.

Another case was where one of our employees had recently moved from another city and needed some extra

money in order to move his furniture and start housekeeping in a proper way. Another case was that of a man who had started housekeeping with a very meager allowance for furniture and had an opportunity to purchase an outfit from an acquaintance who was leaving the city. Another loan was to a man who wanted to enlist but owed several bills about the city for clothing, etc.

It is the practice of this company to pay all employees full wages if injured in our work for the two weeks that are not coverel by the insurance policy and to assist them through the period of convalescence. We have also kept up the pay of all employees who enlisted or have been drafted into the service, paying their families the difference between the government pay and what they were receiving while in our employ.

ANALYSIS OF CONSUMPTION BY SMALL LIGHTING CUSTOMERS

Of Residential Customers 71½ Per Cent Use Less than 20 Kw.-Hr. Monthly as Against 34 Per Cent of Commercial Customers

In preparing a new lighting rate for presentation before a public service commission, a central station found it necessary to analyze the monthly consumptions of small lighting customers. A year's business was taken as a basis in order to eliminate discrepancies between winter and summer requirements, and the customers consuming 20 kw.-hr. or less per month were tabulated in groups by consumption and further divided into residence and commercial classes.

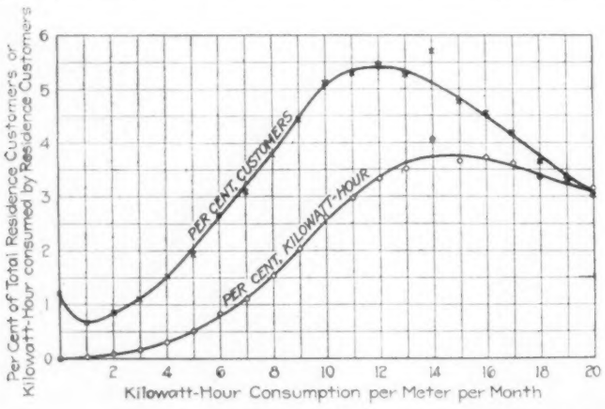
The curves (Figs. 1 and 2) show the results of this analysis, the figures being transformed to a percentage basis. Taking first the curves for residence lighting customers, it will be noted that, eliminating the unusual number of customers having a consumption of 14 kw.-hr. per month (this being the only point which does not fall close to a smooth curve), customers having a monthly consumption of 12 kw.-hr. exceed the rest in number, while the energy curve reaches a maximum at about 15 kw.-hr. It is interesting to note that customers falling into this class (20 kw.-hr. per month or less) constitute 71.5 per cent of the total residence lighting customers on this company's lines.

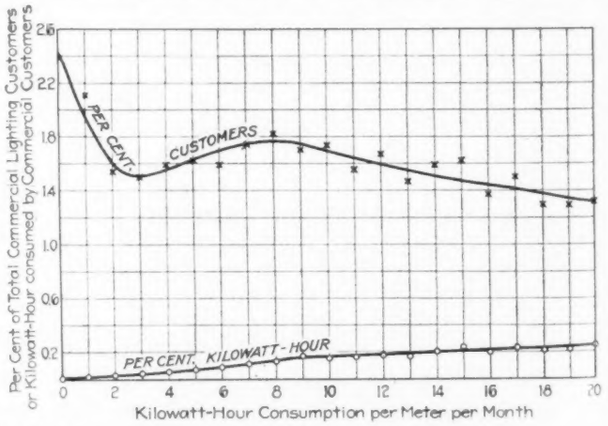
TABLE I—DATA ON RESIDENCE LIGHTING CUSTOMERS

Monthly Consumption, in Kw.-hr.	Per Cent of Total Residence Lighting Customers	Per Cent of Total Energy Consumed by Residence Lighting Customers
0—20	71.5	43.9
21—30	17.0	21.3
31—40	5.7	10.1
41—50	2.3	5.3
51—60	1.1	3.0
61—70	0.6	2.1
71—80	0.4	1.5
81—90	0.3	1.1
91—100	0.2	1.0
101—150	0.4	2.7
151—200	0.2	1.6
Over 200	0.3	6.4

TABLE II—DATA ON COMMERCIAL LIGHTING CUSTOMERS

Monthly Consumption, in Kw.-hr.	Per Cent of Total Commercial Lighting Customers	Per Cent of Total Energy Consumed by Commercial Lighting Customers
0—20	34.0	3.0
21—30	10.8	2.6
31—40	7.5	2.5
41—50	5.6	2.4
51—60	4.5	2.4
61—70	4.0	2.5
71—80	3.3	2.3
81—90	2.7	2.2
91—100	2.1	1.9
101—150	7.8	9.1
151—200	4.6	7.5
201—250	3.5	7.4
251—300	2.4	6.3
301—350	1.8	5.6
351—400	1.2	4.2
401—450	.9	3.4
451—500	.5	2.2
Over 500	2.8	32.5


Per Cent of Total Residence Customers or Kilowatt-Hour consumed by Residence Customers
PER CENT. CUSTOMERS
PER CENT. KILOWATT-HOUR
Kilowatt-Hour Consumption per Meter per Month


Per Cent of Total Commercial Lighting Customers or Kilowatt-Hour consumed by Commercial Customers
PER CENT. CUSTOMERS
PER CENT. KILOWATT-HOUR
Kilowatt-Hour Consumption per Meter per Month

FIGS. 1 AND 2—ANALYSES OF RESIDENCE AND OF COMMERCIAL LIGHTING CUSTOMERS' CONSUMPTION

Their aggregate consumption amounts to 43.9 per cent of the energy taken by all residence customers. The relative importance of the higher classes of residence customers from the standpoint of numbers and energy requirements is shown in Table I.

As might be expected, the small commercial lighting customers are, relative to the rest of their class, of less importance both as to numbers and requirements than the small residential customers. But 34 per cent of the commercial lighting customers fall into the group having a monthly consumption under 20 kw.-hr., and their consumption aggregates only 3 per cent of the total for commercial lighting customers. In the particular district here considered commercial lighting customers were 16 per cent as numerous as residence lighting customers; however, their total requirements aggregated 83 per cent of the consumption of the residence customers. This is of course due to a number of large consumers. The minor importance of the small commercial lighting customers as compared with those of higher consumption is illustrated in Table II.

The city district from which these figures were taken has a population of about 90,000. There are no private plants.

TEN VITAL POINTS FOR ELECTRIC RANGE SALES

In Addition to a Proper Education of Salesmen and Customers, the Central Station Must Always Stand Ready to Serve

BY F. J. ALLEN

Electric Range Specialist, Westinghouse Electric & Manufacturing Company

There are at least ten vital points which every central station should take under consideration when considering the question of range campaigns. A thorough co-operation of the commercial, engineering, construction and bookkeeping departments is the first necessity. The heads of these departments should meet and have a complete understanding of what the central station is contemplating, so as to make the necessary adjustments in their respective departments to give the greatest assistance possible.

The next step is to prepare the selling force. In this connection it is suggested that the assistance of a specialist from the factory be secured. It is essential that the men be sold on the idea of cooking by electricity, its great conveniences, economy and cost. This leads to vital point three, namely, a thorough instruction as to the construction, operation and care of the range. The specialist will undoubtedly lay emphasis on the fourth vital point, that the sale of the range consists of three distinct steps, the sale, the demonstration and the servicing.

Next, the interest of the public must be aroused. Nothing appeals to the public more than demonstration lectures, and here again the support of a factory specialist is advisable. The cooking of an entire meal before an audience of carefully selected "prospects," during which a lecture is given as to the economies, conveniences, fundamental differences and cost of electricity as compared with coal or gas, is an attractive method of procedure. The presentation for inspection of the finished meal at the completion of the lecture is the crowning event of the demonstration. Care should be taken to see that a complete list of those attending the lecture is made for follow-up purposes.

A systematic method for following up these prospective customers is highly essential and can best be handled along the card-index system plan. For every "prospect" there should be a card, and the result of each visit should be listed thereon. When a range is purchased this card should go into the "sold file," and upon it should be kept a detailed report of the operation and servicing of the range, dating from its installation and demonstration. It will be found that this record of dealings with the customer will often prove highly valuable in handling complaints, etc.

It is generally admitted that a deferred-payment plan is necessary. However, whether purchased for cash or on deferred payments, it is advisable to have the buyer sign an agreement according to the plan of purchase, as the signing of such an order has a psychological effect.

The necessity of sufficiently heavy wire and proper transformer capacity is obvious; but in addition every range should be thoroughly explained as well as the fundamental difference between cooking with coal and with gas or electricity. Nearly all ranges are accompanied by instruction books.

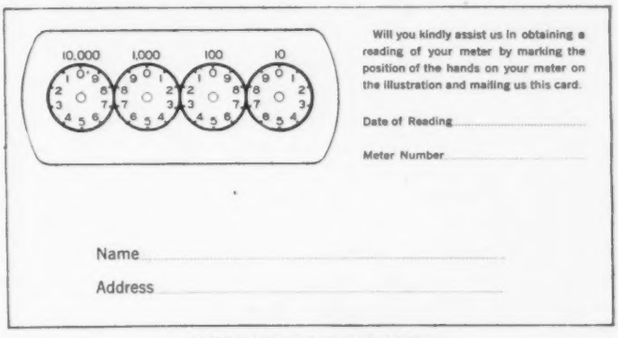
Number nine in the vital points is particularly important, for there is nothing like satisfied customers as a means of desirable advertising. There are bound to be questions arise from time to time regarding the cooking of certain foods, and the author has found that the best solution of these was obtained by getting the different users of the range together. Clubs have been formed of all the purchasers, they electing a president and a secretary. Weekly meetings are held at the homes of the members, the first hour being given over to general discussion of successes and failures. Each member brings a written report on a small card previously given out by the secretary, setting forth the ingredients and electric instruction for the most satisfactory dish she has prepared during the week. These cards are filed at the central station as a "ready recipe" reference for members of the club. The hostess then prepares and cooks some favorite dish as an object lesson for the other members of the club. The meeting is written up in the local papers, and the advertising secured thereby is of the highest character.

The observance of all the foregoing points will have little weight unless the central station equips itself with the necessary parts for quick replacement of any portion of the equipment which may prove defective.

GETTING DELAYED METER READINGS BY POST CARD

Customers Are Asked to Mark the Position of the Meter Hands in Cases Where Reader Could Not Get the Record

Much time is lost by the meter reader through customers not being at home when he calls. In order to get around this difficulty the Twin State Gas-Electric Company of Brattleboro, Vt., asks the customer to read his own meter when the company's reader has not been able to do so on his regular calls.


10,000
1,000
100
10
Will you kindly assist us in obtaining a reading of your meter by marking the position of the hands on your meter on the illustration and mailing us this card.
Date of Reading
Meter Number
Name
Address

POST-CARD METER RECORD

If the meter reader cannot get in, he slips an addressed post card, like the one shown, under the door or puts it in the mail box. This delayed-meter-reading card requests the customer to mark the position of the hands of the meter on the card and mail it to the company. The same consumer is seldom asked to make his own meter reading for two consecutive months; therefore any inaccuracy in the customer's reading is corrected by the company's man on his following visit. Experience shows that the consumer much prefers this method to having his bill figured on the basis of last year or to being billed for two months next time. Space on the card is provided for the date of reading, the meter number and the name and address of customer.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Types of Induction Motors.—J. W. KIRKLAND.—The slip-ring motor is primarily a variable-speed machine and is essential for such purposes as hoisting or variable speed traction. This type is capable of exerting a very high starting torque while taking current approximately proportional to the torque. Practically 90 per cent of the total cost of maintaining motors is in connection with collector rings, brush gear and the external starting arrangements such as liquid starters or controllers. The squirrel-cage motor possesses great advantages over the wound-rotor type for all purposes where the requirements are not for variable speed or exceptionally high starting torque. There are no difficulties in building squirrel cage motors to run at a speed of 1500 r.p.m.—*Journal of South African Institution of Engineers*, April, 1918.

Armature Reaction in Single-Phase Alternators.—F. D. NEWBURY.—A continuation of an article on "Armature Reaction of Polyphase Alternators." The single-phase type of machine can be investigated as to armature reaction in the same manner as a three-phase machine by constructing successive flux diagrams showing the single-phase armature flux during the actual rotation of the field. The effect of lagging current and the cage winding in producing a flux wave is given, together with the armature flux waves taken at several different times. The time and space relations of the flux set up by the armature cage windings are also illustrated when constant armature flux is assumed. A comparison of the result and fluxes shows that the field established by a single-phase cage winding is a rotating field of constant value as in polyphase windings, but the speed of rotation with respect to the rotor is twice that of the rotor speed and the direction of the rotation is opposite to that of the rotor. The effects of armature reaction on generated voltage, the power-factor effects and the results of the armature-flux cage winding are the same for the single-phase as for the polyphase machine with a few exceptions.—*Electric Journal*, May, 1918.

Essentials of Transformer Practice, Part X.—E. G. REED.—The object of this section is to give a general analysis of transformer problems without the use of mathematics. Different types of construction, selection of transformer types and the effect of changing the proportions of a transformer are considered. The ratio of the iron and copper areas and cross-sections to the distributed shell and core types are compared. Two methods of designing are outlined and methods of changing the losses after the transformer has been designed are considered.—*Electric Journal*, May, 1918.

Generation, Transmission and Distribution

Using Volcanic Steam in the Production of Energy.—The province of Tuscany, in Italy, is seamed with volcanic crevasses which emit steam and gas at high temperatures. In 1916 Professor Luigi initiated a project to use this steam to produce electric energy. It was found impossible to apply it directly to the prime movers without damage to the machinery, but by mixing it with pure water it was found practicable to use it with low pressure or medium-pressure boilers without any harm resulting to the steam turbines. At the present time the cities of Volterra, Massa, Sienna, Leghorn and even Florence are receiving at 16,000 volts and 36,000 volts energy generated by this means in a power house where the installation is composed of 3000-kw. turbo-alternators driven by 4000-hp. turbines. It is proposed soon to extend the application of the system to large steel foundries which are now entirely dependent upon coal. It is too early to give exact figures as to the economic saving that may be looked for, but the promoters evidently expect this to be large.—*L'Industrie Electrique*, May 10, 1918.

Efficient Combustion of Bituminous Coal with Underfeed Stokers.—RUSSEL C. HINE.—In discussing this subject the author considers chiefly the kind, quality and characteristics of the fuel, thickness of the fuel bed, rate of feed, formation of clinker, draft and furnace construction. From an operating viewpoint the over-all efficiency decreases as the amount of volatile increases. The rapid distillation and heating that occurs when the furnaces are forced may result in incomplete combustion if the combustion chamber is not of ample size or if the air supply is not properly regulated. The article contains a curve showing the percentage of volatile in coal and illustrations of underfeed stokers.—*Industrial Engineering*, May, 1918.

Installations, Systems and Appliances

Acid-Proof Alloys.—Some experiments by Dr. R. Irmann, described in *Metall und Erz*, have an interesting bearing on acid-proof alloys. It has been assumed that electrolytic corrosion tests of voltaic couples of two metals afford an indication as to the corrosion of the alloys of those metals. The investigation by Dr. Irmann of alloys of copper and nickel, to which tungsten and iron were further added, apparently disproves this assumption. Much depends upon the proportions and the formation of compounds. An alloy of nickel with 20 per cent of tungsten was more resistant to attack by strong hot sulphuric acid than nickel alone, but was difficult to machine and expensive. A voltaic couple of nickel and copper gave an emf. of 0.55 volt, which soon decreased to 0.25 volt. The nickel was dissolved, the copper becoming polarized with hydrogen. An alloy of 47 per cent copper and 4.98 per cent tungsten proved highly persistent and mechanically strong. The electric resistance was greater than that of constantan. Very good results were also obtained with ternary nickel—tungsten—copper alloys. But quaternary alloys, containing also iron, proved far superior to the ternary alloys.—London *Electrician*, April 26, 1918.

Electrophysics and Magnetism

Thermo-Electromotive Force of Some Alloys.—M. A. HUNTER and J. W. BACON.—The measurements were obtained by joining a number of the wires directly to a standard iron-constantan thermocouple with soft Swedish iron wire. The standard thermocouple indicated the temperature of the hot junction. Nickel-chromium-alloy, copper-nickel chromium, iron-nickel, iron-nickel-chromium, nickel-manganese and iron-nickel-manganese curves and tables are presented. Nickel chromium alloys and copper-nickel-chromium alloys will meet all conditions which have been laid down for a satisfactory thermocouple because their curves are approximately straight lines. The materials have a high melting point and resist oxidation very well.—Extracted from paper presented before the American Electrochemical Society, April 28-May 5, 1918.

Electrochemistry and Batteries

Catalytic Action of Carbon in Batteries.—Contribution to the Société Internationale des Electriciens by M. Fery. Depolarization is effected through the action of the air, but the part played by the carbon in this action is somewhat obscure. On first thought it would seem that the only factors of importance in facilitating the catalytic action of carbon in conveying oxygen from the air are the nature of its surface and its porosity. But experiments have shown that the constitution of the carbon is also of importance. Seeing that all catalytic agents are affected by the presence of small impurities, it is hardly surprising that carbons apparently similar differ widely in their behavior. Moreover, certain qualities of sal ammoniac containing traces of iron and lead also hinder the action of catalysis. The presence in the pores of the carbon of a gelatinous film of metallic hydroxide has a deleterious effect. The purity of the carbon is therefore a vital factor. Some results are given for batteries using the special carbons manufactured by the Société Gallot as a result of M. Fery's researches. A battery containing 100 gm. of sal ammoniac with 77 gm. of zinc, and supplying 20.8 milliamperes (0.5 amp.-hr. per day) consumes 1.27 gm. of zinc per ampere-hour, as compared with a theoretical consumption of 1.2186 gm. The efficiency is thus nearly 95 per cent. The consumption of sal ammoniac was also considerably decreased, being only 1 gm. per ampere-hour. If the above current is maintained by adjusting the external resistance, the emf. falls from 1 volt to 0.5 volt in four months, and the cell will then continue in action if the zinc is reversed.—London *Electrician*, April 19, 1918.

Telegraphy, Telephony and Signals

Synchronous Signaling and Safety at Sea.—Recent developments in methods of signaling between ships and shore stations, as well as between ships at sea, with the object of averting collision, were outlined by Prof. J. Joly before the Royal Institution on April 9 and 10. He said that the difficulty attending the use of light signals in foggy weather has been overcome by the use of wireless signals. The latest type of Fessenden oscillator has opened up new possibilities in sound signaling in water, this device enabling the range of audibility to be increased up to 30 miles per hour and also permitting signaling by Morse code by the ordinary telegraphic key. Furthermore, the receipt and emission of signals can be accomplished by the same apparatus. To these advantages are added the possibility of locating icebergs by reflection of sound and the determination of depth of water beneath moving vessels by echo from the sea bed. The latest development is the employment of wireless telephony. The installation of the radiophone on the De Forrest system at Point Judith, on the western approach to Narragansett Bay, is the first of its kind. This station communicated its name over a considerable distance and on vessels approaching within the danger zone gave a second warning.—London *Engineer*, April 19, 1918.

Miscellaneous

Relative Resistance of Various Hard Woods to Injection of Creosote.—CLYDE H. TEESDALE and J. P. MACLEAN.—When wood is impregnated with preservatives some species are more easily penetrated than others, so that for proper treatment the species should

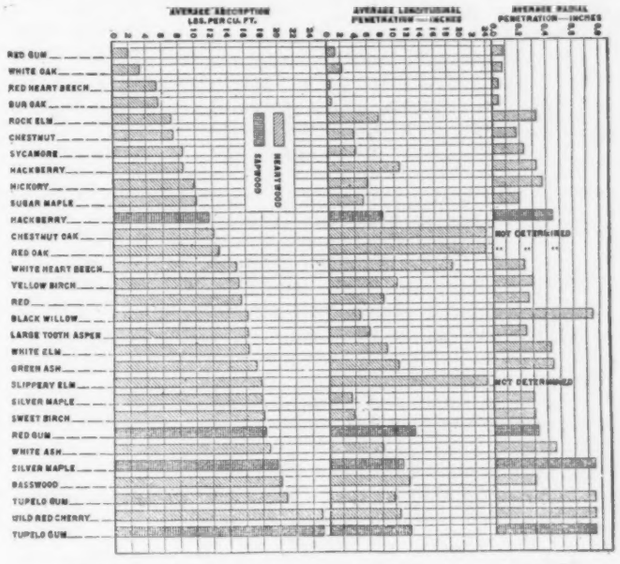


CHART OF ABSORPTION CHARACTERISTICS FOR VARIOUS HARD WOODS

be grouped according to their relative resistance to injection, otherwise part of a cylinder charge might receive a heavy treatment and another part a very light one. The accompanying chart shows the relative absorption characteristics of different kinds of pole timber. A very complete bibliography of departmental publications on this and allied subjects is included.—*Bulletin No.* 606, *U. S. Department of Agriculture.*

Pulverized Fuel.—(Report of fuel and fuel-handling committee of the Naval Consulting Board.) In addition to the definite economies that have been claimed for the use of pulverized coal as a fuel in stationary practice, there are other advantages which occur in marine installations that help military operations. By a simple and immediate adjustment of the burners powdered coal as a fuel may be made to emit dense clouds of smoke to serve as a screen; in an emergency the ship's boilers may be rapidly forced; a great reduction in the fireroom force is effected as compared with the use of solid coal; the supply of fuel oil in the United States is limited, and a means of conserving fuel oil for naval vessels already equipped to burn oil is necessary.—*Journal of American Society of Mechanical Engineers*, May, 1918.

Reversing Motor-Planer Control

To the Editor of ELECTRICAL WORLD:

Sir: The subject of reversing motor-planer control, covered in the Jan. 12 issue, points out the feature of dynamic braking for every reversal of the platen when the machine is producing work. From this the reader would be inclined to believe that this feature is essential and the only means of operating satisfactorily.

Dynamic braking is not necessary for the most efficient operation, when the planer is in service. With one system particularly familiar to the writer the motor is thrown directly into reverse just before the platen reaches the end of the stroke, but the armature current is limited to a fixed amount by proper proportioning of the resistances. Two starters are used mounted on the same panel. When the table switch is tripped by the "dogs" the motor is started up in the reverse direction on the idle starter, with no loss of time and without first slowing up the platen by dynamic braking. This gives a quicker, smoother and more accurate reverse than with any system using the dynamic brake. It has also been demonstrated with this system that a truer line of reversal is obtained; that is, the point at which the tool stops will be practically along the same straight line at each reversal. On a recent test, a 35-hp. controller of this type showed a variation of ¼ in. (0.63 cm.) on a 2-ft. (0.608-m.) stroke, which is closer than can be obtained by dynamic brake. This is often important when working to a recessed shoulder, etc.

In the system mentioned dynamic braking is applied only when the operator desires to stop by push-button or tumbler-switch control, overloads or failure of voltage. This system gives all the desirable features of jogging and hand control when setting up work and a longer life to the contacts.

MONITOR CONTROLLER COMPANY,
W. G. Merowit, District Manager.
Baltimore, Md.

Ventilating Cable Ducts

To the Editor of ELECTRICAL WORLD:

Sir: In an editorial in the April 20 issue of the ELECTRICAL WORLD entitled "Ventilating Cable Ducts" you make the following statement: "The experiments described by Messrs. Keating and Mueller are certainly of considerable value in showing for the first time on a really practical scale what can be done if necessary to keep down dangerous temperature in high-tension cables." The experiments referred to were in connection with the cooling of ducts with forced ventilation, a method studied by the Duquesne Light Company of Pittsburgh, Pa.

Some very careful tests of this kind were made by the writer about fifteen years ago, with the result that the temperature was found to "build up" toward the exhaust end of the conduit and, unless an extraordinary amount of energy was used to drive the air through the ducts at high velocity,

Readers' Views and Comments

higher temperatures of the cable resulted than if the blowers were not running. These tests were made in a 200-ft. (60.9-m.) section of conduit. This "building-up" effect would be much greater where the manholes are the usual distance of 400 ft. or 500 ft. (122 m. to 152 m.) apart.

Beginning on page 233 of Volume XXXIV of the *Transactions* of the American Institute of Electrical Engineers, there is a paper by the writer on "Effect of Moisture in the Earth on Temperature of Underground Cables." The method there described has been adopted by the Niagara Falls Power Company to "keep down dangerous temperatures in high-tension cables" and has been in extensive use for at least six years. Two other large companies at Niagara Falls have adopted the same method of water cooling. No cable failures from electrolysis have been experienced, and if adequate bonding of cable sheaths and ground connections in manholes are provided there will be no trouble from this cause.

The installation of the plant, as well as the cost of operation and maintenance, for cooling cables in ducts by water is very slight compared with the cost of a blower plant.

Niagara Falls. L. E. IMLAY.

Self-Inductance of Long Reactance Coils

To the Editor of ELECTRICAL WORLD:

Sir: I read with much interest H. B. Dwight's article on "Self-Inductance of Long Reactance Coils" in the issue for Feb. 9. While Mr. Dwight's work is well done and is of academic interest, it falls short of meeting practical manufacturing conditions.

In usual manufacturing it is not possible with present production methods to meet exact conditions except by overwinding a reactance and then adjusting to exact value. According to General Electric Company data No. 14,815-A, which are representative of others, copper wire is subject to variations as follows:

1. Bare diameter 1 per cent high or low down to 10 mils and 0.1 mil higher or lower below 10 mils.

2. Cross-section 2 per cent high or low down to and including 10 mils diameter.

3. Weight 2 per cent high or low down to and including 10 mils.

4. Temperature coefficient 0.00393, or 1/254.5 per deg. C. from 20 deg. C.

On account of these variations in wire of commercial sizes and the impossibility of exactly determining spacing of wires, especially in small coils, it is not necessary to use any method which has a greater accuracy than 2 to 3 per cent.

Mr. Dwight would use several different formulas for different coil shapes. Here the error of taking the wrong formula is possible, which means elaborate checking of all results.

I have found it convenient to use a universal formula and curves based on theoretical and empirical considerations. The formula and curves are given by Brooks and Turner in Bulletin 53, University of Illinois. The Brooks-Turner formulas and curves have been checked and found to be correct for all usual engineering and manufacturing problems.

H. E. WEIGHTMAN,
Chicago, Ill. Engineer.

Conserving the Small Water Powers of Alabama

To the Editor of ELECTRICAL WORLD:

Sir: There are three kinds of natural material resources which the nations must conserve, and more especially should the United States and our allies at the present time use drastic means along all lines of conservation in order to win the war within the next three years. The non-renewable resources, such as coal, ore, oil, gas, phosphates, manganese, etc., in which utilization, even though without any waste, necessarily diminishes the supply for future generations, form the first class. The self-renewing resources, such as forests, which time will replace for future generations, form the second class, and water power forms the third. If water power is not utilized, it is wasted, with no good results to anybody, and instead of restriction, as with the other classes, the greatest possible use should be advocated.

Alabama is wonderfully blessed with numerous small streams where from 10 hp. to 200 hp. could be developed, and the number of large streams is great compared with most other states. Small streams which can find enough storage to produce 50 hp. ten hours a day for manufacturing purposes are saving fuel at the rate of nearly 400 tons a year and thereby rendering a great service to coal conservation.

We have to-day in our state more than 800 water-power developments ranging from 6 hp. to 50 hp., and more than eighty developments ranging from 50 hp. to 200 hp. This is only a beginning, because the future possibility for large and small water-power developments in Alabama is really great. We are now witnessing the progress of the project at Muscle Shoals, which will ultimately generate 50 per cent more horsepower than is now produced at Niagara Falls. As fuel is scarce and many power stations are greatly inconvenienced in getting their coal supply, it seems to be the proper time to diminish restriction all down the line and to use public authority so far as possible to encourage the development and utilization of every bit of water power which can be commanded.

WILLIAM L. WHITE, B.Sc., M.E.
Testing Engineer T. C., I. & R. R. Co.
Laboratory, Ensley, Ala.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

CALIFORNIA'S COMMISSION ACTS IN POWER CRISIS

Takes Over the Distribution of Electricity in Central and Northern Sections and Appoints a Power Administrator

The Railroad Commission, with the approval of the electrical power companies interested, has taken over the administration of electric power in northern and central California to meet war emergencies. In connection with this action the commission has created a Department of Power Administration, to be in charge of H. G. Butler, for five years assistant chief engineer of the commission.

The power companies have agreed to have their entire output pooled and distributed by the Railroad Commission so as best to serve the need of all consumers in the present crisis, as outlined in these columns last week. The expenses of the Power Administration will be borne by the power companies. Administrator Butler has announced that no power priority list has been adopted and that effort will be made to avoid the necessity of such a list by the utmost conservation of power.

If it becomes necessary to create a priority list, this will be done only after consultation with the Food and Fuel Administrations, the Emergency Shipping Board and the Federal Reserve Board. It is hoped that the power pool will improve economy so as at least to postpone curtailment of service.

WAR INDUSTRIES BOARD SEEKS CAPITAL FOR POWER PLANTS

Bill to Appropriate $200,000,000 to Increase Power Supply in East Is Sent to Congress—Frederic Darlington Approves

The War Industries Board has sent to Congress the draft of a proposed bill to appropriate $200,000,000 to increase the power supply in overloaded industrial centers of the East. Cities along the Atlantic seaboard in which munitions and materials for war are being manufactured would be the especial beneficiaries under the measure, which has been committed to the care for the present of Representative Kitchin, chairman of the House ways and means committee, on the House side, and of Senator Martin of Virginia, chairman of the appropriations committee, on the Senate side.

The measure, it is understood, was drafted by Frederic Darlington, chief of the power-plant section of the War Industries Board, at the request of Bernard M. Baruch, chairman of the board, and it is said to have the backing of President Wilson.

The measure is frankly emergency legislation, made necessary by the apparent need of the industrial section of the East for more power with which to turn out munitions of war. It is stated in Washington that the power supply of the East is obviously overloaded, and that while different sections of the country are also raising the question of not having sufficient power with which to turn out the munitions and materials needed by the government, it is the intention of the War Industries Board to see that the Eastern section of the country is supplied first, and then endeavor, perhaps by additional legislation and appropriations, to supply other sections of the country.

Until recently, it is stated in Washington, power companies without sufficient equipment and without sufficient funds to purchase equipment had expected to be assisted in obtaining capital and equipment through the War Finance Corporation; but now that that body has ruled in a manner which makes it unlikely that power companies can be so supplied, the need for empowering legislation of a specific and emergency character becomes apparent as one of the necessities for winning the war. It is said in Washington also that some of the power companies have come to see that if they borrow money now for additional equipment which might not be needed at the end of the war they will be doing themselves more harm than good.

It is said in Washington that much more than the $200,000,000 proposed for appropriation will be needed, inasmuch as in the Pittsburgh district alone, which supplies power for a radius of 100 miles, it is estimated that $40,000,000 or $50,000,000 for additional plant facilities might be needed.

Secretary Daniels at the General Electric Works

In his tour of inspection in the Empire State Secretary of the Navy Daniels visited the Schenectady Works of the General Electric Company. With national and State officials he inspected the work being done for the United States Navy Department, paying particular attention to the turbines and turbine gears for destroyers and to the electrical equipment for battleships. At noon Secretary Daniels addressed the 23,000 General Electric employees.

CHARLES L. EDGAR ON WAR AND RATE PROBLEMS

Asking to Have Boston Investigation Postponed Until Close of the War, He Analyzes Conditions and Prospects

President Charles L. Edgar of the Edison Electric Illuminating Company of Boston appeared as a witness on June 6 before the Massachusetts Gas and Electric Light Commission in connection with the company's motion to defer the pending rate investigation until the close of the war. He supplemented previous statements regarding the matter as published in the ELECTRICAL WORLD of May 18, page 1053, and June 8, page 1186.

Mr. Edgar said first that the shortage of labor in accounting departments was the cause of bi-monthly billings being considered by the larger central stations. He felt that the practice has great disadvantages, tending to increase bad debts and not cutting down accounting work pro rata. Despite the disadvantages, it may be necessary to adopt the plan. The accounting staff shortage is one of the most serious obstacles to a rate investigation under present conditions.

Referring again to the retention of the firm of D. C. & W. B. Jackson of Boston and Chicago to analyze the company's earnings and rates and point out specific prices considered too high or too low, Mr. Edgar said that on account of the inroads of the war into the staff of this firm and the recent commissioning of its heads for government service the report on rates will not be ready for some time.

"If under the circumstances we were going into an investigation such as is intimated by these questions" (presented by the advocates of a rate reduction), the speaker declared, "I am very much at a loss to know what we could do. Apparently, judging by the questions, this is proposed to be as thorough an investigation as has ever been made by anybody. It deserves all our thought and all your thought. . . . Without the help of a firm like that of Mr. Jackson, and with all of us busy on more or less important things, acute things to which we have to give our thoughts, I don't know just what we could do if we had to go on with this case."

How Conditions Have Altered in a Year

A year ago, the witness stated, the company took the position that the time had come to reduce the maximum lighting rate from 10 cents to 9 cents, and a material reduction in power prices was also in sight. This is no longer the case, in view of the extraordinary increase in expenses. Mr. Edgar estimated that daylight saving will cost the company nearer $400,000 than $250,000, as estimated at the last hearing.

"Dr. Garfield told us week before last in Washington," said Mr. Edgar, "that he was going to put lightless nights into effect this year on Sept. 1 and that he had no doubt there would be more workless days this winter than last."

The witness was of the opinion that a continuance of the recent dimming order of the police in the New York district would cost the central station interests $1,000,000 a year. The same situation may be met in Boston at any minute.

Commissioner Schaff intimated that the company's staff might meet the demands of the investigation without the need of calling in outside assistance.

Mr. Edgar said that a reduction of 1 cent per kilowatt-hour in the present Boston price would mean about $400,000 decrease in revenue. He had not considered the question of making a tentative maximum price for a certain period, feeling that in due course the company will have to satisfy the commission that not only should there be no decrease, but that there should be an increase, and probably a large increase, in all prices. Another million dollars of income should be obtained from existing customers within the next year or two, taking into consideration the prices that will have to be paid for coal and the loss of income from conditions beyond the company's control, such as industrial shutdowns.

The Coal Clause Will Not Cover All the Loss

"We will get quite a lot out of our coal clause," he said, "but we cannot get it all. We cannot even get all that we should in that way in connection with our coal, because some of our contracts tie us up for a year, and we have some longer contracts. But if we could put our coal clause on to our business we could get back half of the loss expected. The other half, if we get it, has got to come out of existing customers. . . . In normal times it is entirely possible, in my opinion, for your board, for the petitioners or for the company to decide, if prices are to be changed, where they should be changed. I think it is entirely impossible in these abnormal times for either your board, the petitioners or ourselves to determine where the prices should be changed scientifically at present.

"The whole theory of the rates is that they depend upon precedents, things that have grown up. For example, a city that had 90 per cent of its business light and 10 per cent power would have an entirely different ratio between the power and light prices from a city that had 90 per cent power and 10 per cent light. Our company is to-day in the position of not knowing what our ratios are from day to day. Our output yesterday was 25 per cent ahead of last year. . . . Now, the output of yesterday cannot, in my opinion, be figured by anybody as a proper basis of rates for the future."

In the past, Mr. Edgar intimated, rate reductions in unsaturated territory have generally been recouped in net earnings within twelve to eighteen months. The entry of the country into the war has made previous standards of prediction more or less unreliable, in view especially of the greatly increased prices in labor and supplies and the possibility of almost confiscatory taxes to help carry on the war. Under normal conditions the great bulk of new business obtained by the Boston company comes during the four fall months. After the holidays the people drift along without making changes in their living arrangements until late in the spring. Then the company in normal times gets a minor boom in new business, after which matters are quiet until after Sept. 1.

A Patriotic Reminder—Have You Bought Your War Savings Stamps?

Last summer, Mr. Edgar pointed out, he was willing to put into effect a reduction in the retail lighting rate from 10 cents to 9 cents and expected that a good part of the loss in net could be recouped by midwinter. A letter to this effect written to G. S. MacFarland, counsel for the petitioners, was introduced. At that time Mr. Edgar declared that if the price was reduced from 10 cents to 9.5 cents the result would be very largely negligible, whereas a reduction below 9 cents, say to 8.5 cents or 8 cents, would be so great as materially to decrease the company's income. The petitioners desired to know why a reduction below 9 cents did not appear feasible to the company last summer, and the answer was that the company felt it wise to offer a reduction large enough to be an incentive to secure new business but not so great as seriously to imperil its net earnings. Had the proposed reduction to 9 cents been made, the company would have utilized the occasion to conduct an extensive advertising campaign for new business; and even if it could have seen its way clear to go to 8 cents within a reasonable number of months at that time, Mr. Edgar felt that it would be good business and undoubtedly to the interest of the company and its customers to make the reduction at two different times and get the benefit of two advertising campaigns. It was then Mr. Edgar's opinion that by such a course the company would get twice as much business as though it had made only one campaign, even though the reduction was twice as much in the one as it was in each of the two.

Loss Through Lower Rates Cannot Be Made Up

"Last July," said Mr. Edgar, "I thought revenue lost through reduced prices could be picked up. We know now that it cannot be. We know that the government will not let us pick it up. I have been told in the last two weeks that the government was going to stop the manufacture of appliances, heating devices and ranges, which will mean a great dropping off in new business. We are told that the general policy of the government is going to be to stop extensions. If we cannot make extensions we cannot get people to take more light, and if we cannot sell heating devices it means that our new business is going to be stopped. I am speaking now of the business that is reflected in the retail rates. I am not speaking of the war business. That is going ahead enormously, but if we cannot pick up our business we cannot get our income back by a reduction. We cannot do any advertising.

"It would be very bad judgment for us to go out and have an advertising campaign for new business, especially when we are short of money. Everybody knows we are short of money, and we cannot boom business and then refuse to take new customers; we are refusing them to-day by the hundred. It is inconceivable to me that anybody would suggest that we can afford reducing retail prices in the light of what is happening. The whole situation is in a very feverish condition. I think we know something about rates, and I think personally I know something about rates; but I would not know how to go at it at the present time, because if you pass upon the matter from a determination of conditions, conditions can change to-morrow."

Mr. Edgar said that up to Oct. 1, for six or eight months after the declaration of war, the company was going along about normally. The gross earnings were increasing 6, 8 or 10 per cent, and the net were increasing in like proportion. In November, 1917, the output dropped from 10 or 12 per cent increase to about 6 per cent. The earnings still kept up. In December the increase was only 6 per cent, and in January it dropped to minus 2 or 3. For three months the figures were minus. In April, 1918, there was an increase in gross earnings of about 5 per cent. For the first time in the history of the company its net earnings are running less than the year before, the reduction running roughly from $23,000 to $40,000 per month.

The coal clause has been applied to all except the company's "A" rate (retail lighting), and even if all the power customers could be billed at present on the coal clause basis, the company would make no extra profit, but would get back the exact expense to which it has been put more than it would have had to meet if it could have secured coal at the prices of 1916. At present the cost of coal is about $2 per ton above the 1917 prices, and it will probably reach $3 extra (against 1917) before the end of June. Mr. Edgar said that the New England Power Company has been negotiating with the Edison company for the supply of 30,000,000 kw.-hr. per year to the former by the latter during periods of low water. Mr. Edgar said that he thought the Boston Edison 10-cent rate might have to be raised to 12 cents in future, in view of the advances in prices apparent throughout the country, and especially as evidenced in the recent horizontal increase in railroad rates of about 25 per cent.

Frederick Manley Ives, counsel for the Edison company, addressed the commission during the hearing upon the recognition by other regulative tribunals of the desirability of postponing rate investigations of an exhaustive character during present war conditions.

Granville S. MacFarland, counsel for the petitioners for a rate inquiry, took issue with the company's contention that the present is not a proper time in which to carry through a rate investigation of the scope proposed. The commission took the matter under advisement.

MISSOURI UTILITIES GO BEFORE STATE COMMISSION

Resolution Recounting Present Difficult Conditions Presented by Eighty Representatives of Public Service Properties

About eighty representatives of Missouri public utilities presented to the Public Service Commission at Jefferson City on June 10 a resolution which was prepared at the convention of the Missouri Association of Public Utilities at St. Joseph on May 17 and 18. It said that the commission should recognize as fair the operating ratios which existed before the war.

Those who addressed the commission and the utility men were Colonel P. J. Kealy, Kansas City; J. H. Van Brunt, St. Joseph; H. Spoehrer, St. Louis, and E. C. Deal, Springfield.

Every Little Helps — Buy Your War Savings Stamps

PLEA MADE FOR HIGHER RATES IN INDIANAPOLIS

Testimony Begun on Petition of the Two Companies for Authority to Add a War Surcharge to Their Energy Prices

A surcharge of 1 cent or 1½ cents a kilowatt-hour on all electric energy furnished in Indianapolis may be asked by the Merchants' Heat & Light Company, which began the presentation of evidence June 17 before the Indiana Public Service Commission on its petition for authority to make a surcharge.

J. W. Fesler appeared as attorney for the Merchants' Heat & Light Company, and Charles N. Thompson and Elmer E. Scott as attorneys for the Indianapolis Light & Heat Company. Samuel Ashy and Thomas D. Stevenson entered appearances for the city of Indianapolis.

The attorneys for the city filed an answer to the petition in which they said that the petitioners "are not entitled to make a normal profit in these abnormal times, and that they should be required to stand their full share of the burden of the war, without transferring the same to their patrons through increased rates."

Mr. Fesler expressed the opinion that without any surcharge whatever, and with an estimated increase of 6½ per cent in the volume of the company's business, and counting the increased cost of coal and other items at operation, the deficit of the company would reach $677,000 next year.

The Indianapolis Light & Heat Company introduced a brief to support its contention that it should be granted a new surcharge, which would more than recompense it for the financial loss when its present authorized surcharge of 5 mills for each kilowatt-hour of energy consumed becomes ineffective following June 30. Under the existing surcharge, $214,238 additional revenue above pre-war rates had been made possible during the year ending June 30, 1918, two months being estimated. Of this electric consumers paid $194,382, and steam heating, $19,855.

While gross operating revenue increased over the corresponding period last year, there has been no increase in the average price per kilowatt-hour sold, and there have been heavy increases in costs of operation and in fixed charges. In addition, the requirements for extensions, additions and betterments to take care of the increased demands during the past year have required the company to spend $1.92 for each dollar of increased revenue received.

The increasing price of coal, which cost $2.945 a ton during the two months ended June 1, 1918, was discussed, and then the company declared that the operation of Indiana's new prohibition law decreased its revenues annually approximately $26,000 a year. This estimate was based on the loss of business in April.

At the hearing on Wednesday it became apparent that the commission intends to authorize an increase in electric power rates, especially a higher rate for large consumers, in proportion to the increased cost of coal, labor and materials.

This outlook developed when calculations by the commission and the witnesses for the Merchants' Heat & Light Company showed that the switchboard cost per kilowatt-hour for the year ending June 30, 1918, would be 9.71 mills, without allowing for cost of distribution or interest on investment, or about 1 mill more than some of the large consumers would pay on the rates before the surcharge of 5 mills was authorized by the commission last year.

The surcharge of 5 mills authorized last year applied to all energy except that used in homes. The companies are asking for a new surcharge on residential as well as commercial energy.

BANKERS INVESTIGATING PUBLIC UTILITY RELIEF

Committee of Four Named in New York at Suggestion of Governor Harding of Federal Reserve Board—$100,000,000 Plan

At the suggestion of W. P. G. Harding, governer of the Federal Reserve Board and managing director of the War Finance Corporation, a committee of four New York bankers has been formed to investigate financial needs of public utilities with the object of preparing a plan by which capital may be furnished for them. The committee is: James N. Wallace, president Central Union Trust Company; Charles H. Sabin, president Guaranty Trust Company; Thomas W. Lamont of J. P. Morgan & Company; Frederick Strauss of J. & W. Seligman & Company.

The committee is considering the organization of a corporation with $100,000,000 capital. This corporation would purchase utility securities, and its notes would be discounted by the War Finance Corporation. Bankers throughout the country would subscribe to the stock. This would distribute the risk and also serve to encourage active co-operation from all sections. Adoption of this plan would do away with the necessity of amending Section 7 of the War Finance Corporation law.

The War Finance Corporation announced on June 19 that it would loan directly to the Brooklyn Rapid Transit Company $17,320,000. The advance is based on a plan requiring holders of the company's notes due on July 1 to exchange not less than 70 per cent of the face amount of the notes for new three-year 7 per cent notes of the company.

MANUFACTURERS ALERT TO THE STEEL SITUATION

Control of Distribution of All Manufactured Steel Products and Pig Iron Touches the Electrical Manufacturers

Control by the War Industries Board of the distribution of all manufactured steel products and pig iron touches directly the question of operation of electrical manufacturing industries during the war. The electrical manufacturing industries are doing a large amount of work directly or indirectly for the government. More and more they are converting their output to essential products.

Manufacturers are now studying their manufacturing processes with great care so as to conserve raw materials, and especially those in which shortage exists or threatens. They are also studying their business in order to determine definitely what is essential war production and what belongs to the less essential classes.

Great War Savings Stamp Drive in Indianapolis

The $5,000,000 war savings stamp drive in Indianapolis and Marion County was inaugurated by Theodore Roosevelt before 15,000 people on June 11. The largest cash register in the world was erected by the side of the office building of the Merchants' Heat & Light Company, the busiest corner in Indianapolis.

MORE EFFICIENCY IN STEAM-PLANT OPERATIONS

Papers Presented by Eskil Berg and D. W. R. Morgan Before Joint Meeting of Engineering Societies in Chicago

"The Advantages of High Pressure and Superheat as Affecting Steam-Plant Efficiency," by Eskil Berg of the General Electric Company, and "Condensers," by D. W. R. Morgan, engineer condenser department Westinghouse Electric & Manufacturing Company, were the topics of papers presented before a joint meeting of the Chicago Section, American Institute of Electrical Engineers, the electrical section and mechanical section of the Western Society of Engineers and the Chicago Section of the American Society of Mechanical Engineers at Chicago on June 17.

Mr. Berg strongly favored the adoption of higher pressures and higher temperatures than are now considered standard in this country in order to improve plant efficiency. He especially favored higher pressure. His paper was replete with data showing the possible saving in fuel which can be made through these processes. As indicative of the character of these data, Mr. Berg presented a table showing that a plant operating with 800 lb. boiler pressure and 800 deg. superheat, containing turbines 85 per cent efficient and boilers 88 per cent efficient, could produce 1 kw.-hr. on 11,750 B.t.u.

Mr. Morgan described the improvements in the art of condenser building which have been made by the Westinghouse company. He also predicted that the war would probably make it necessary for central stations to use more jet condensers and to use steel tubes or tubes of other than bronze metal in surface condensers in order to conserve for actual war uses metals more sorely needed.

In the discussion, Harold Almert, consulting engineer, who has been appointed by the State Council of Defense to see that coal is burned economically in Cook County, stated that Chicago and the remainder of Cook County alone consumed 33,000,000 tons of coal annually. He expects to make a 10 per cent saving on this consumption by asking increased diligence in the larger plants and taking such steps as are necessary to guarantee better efficiency in the 90,000 small plants operating in the district.

The remainder of the discussion was largely confined to questions which were answered by Mr. Morgan and Mr. Berg. Among those who took part in the discussion were C. V. Kerr, M. J. Kermer, A. D. Bailey, F. R. Wheeler and Mr. Heald.

Answering a question on the cost of high-temperature and high-pressure equipment, Mr. Berg expressed the opinion that after development charges have been eliminated this equipment will be cheaper than that now produced for standard pressures and temperatures.

Mr. Morgan in his closing remarks urged attempts to go from 28 in. to 29 in. (71 cm. to 73 cm.) of vacuum, thus effecting a saving of 4 per cent.

WASTEFUL USE OF ELECTRICITY MUST STOP, SAYS DR. GARFIELD

Complaints Have Been Made that Excessive Illumination Still Prevails and that Signs Are Sometimes Lighted in the Daytime

Fuel Administrator Garfield warns the public against prodigal and unnecessary use of electricity for outdoor advertising purposes and other display illumination.

Reports made to the Fuel Administration by state and county administrators and letters received from individual observers are to the effect that owners of theaters and other establishments frequently turn on their display signs and outdoor lights during the daylight hours and that both municipalities and individuals have returned to the habit of excessive illumination.

The Fuel Administrator said this waste must be stopped. Unless official reports show that display illuminations are kept within reasonable bounds and are limited to the hours of darkness, the suspension of the so-called "lightless night" order will be revoked and even more stringent restrictions will be ordered against all forms of outdoor lighting and display illumination.

IN PAST wars victory was thought largely a matter of purely military strategy. Under our highly organized system of to-day the whole weight of the nation must back up with its full resources military and naval action. . . . We are building ships not alone for the war but for the future of world trade. . . . The building of ships, the mining and distribution of coal, the production and conservation of food products and other important war necessities are all vital to the nation's needs during these trying times. We may make mistakes, but we are moving forward and getting results. If each of you will do your part, putting your country above everything else, we will win.—*Edward N. Hurley, before the National Coal Association.*

PROGRESSING TOWARD THE RECONSTRUCTION COMMISSION

Plan for Such an Agency to Prepare for Vital After-the-War Problems Is Under Consideration in Washington

Following the presentation in the ELECTRICAL WORLD of a concrete plan for a proposed Readjustment and Reconstruction Commission, to be appointed now by the President of the United States, to deal now with problems which will be presented to American industry after the war, it has become known in Washington administrative circles unofficially that a plan for a readjustment and reconstruction agency is under consideration.

The Council of National Defense has been studying the subject for a long period, with a view to co-ordinating various government activities in Washington which have had readjustment and reconstruction for their object. When President Wilson recently set up the War Industries Board, under the chairmanship of Bernard M. Baruch, as a separate agency, divorcing it from the Council of National Defense, the latter organization was left with but little work to do. There is reason for the belief that the Council of National Defense has resolved to undertake the work of readjustment and reconstruction, if permitted to do so by President Wilson, and there is also reason for the belief that the President will assent, under the urging of Secretary of War Baker, chairman of the council, acting in behalf of himself and the other five members of President Wilson's cabinet who compose the Council of National Defense.

In Washington official circles there is an impression that this would be logical inasmuch as a number of cabinet officials have begun making public details of readjustment and reconstruction ideals upon which their departments and bureaus have been at work, and there is ground in Washington for the strong belief that if the Council of National Defense is authorized by the President to begin work on readjustment and reconstruction problems, W. S. Gifford, director of the council, will not only set to work at once to co-ordinate all the work in the various departments but will undoubtedly call into consultation and activity at Washington men in private industry.

The subject is now being discussed in Washington, and letters and telegrams are being received urging the creation of such an agency at once.

Philip H. Gadsden, chairman of the National Committee on Public Utility Conditions, strongly indorses the idea of action, saying:

"The great lesson which this war has impressed upon every one is the efficiency resulting from great concentration of capital and labor. The benefits derived by the nation for war purposes in the mobilization of practically all the industries of the country will not be lost sight of when peace comes. To deal properly with such a radical change in our economic policy will call for all the wisdom at our command. Nothing could aid so much in the proper solution of such a problem as a thorough and comprehensive study of it in advance, such as you suggest."

From the Permutit Company, engaged in water rectification and general sanitation, New York, comes this letter, signed by Samuel Robert, president:

"As we see it, there can hardly be room for doubt as to both the usefulness, and, indeed, the necessity, for work of the nature referred to, and that this work should be done as quickly and as thoroughly as possible.

"We can think of no better way to prepare the groundwork essential to the proper accomplishment of this vital project (vital to the future benefit of the industries of this great country) than by having a commission appointed as quickly as possible for the express purpose of investigating the necessary steps to prepare for its accomplishment."

Charles F. Lang, president of the Lakewood Engineering Company, Cleveland, Ohio, writes:

"While our company is working night and day on war service for the government, and is constantly endeavoring to expand its usefulness in this direction, all our planning is being done with a view to world-trade conditions after the war, for we feel that we but dimly realize the demands which world trade will make upon American manufacturers in the reconstruction period immediately following the war.

"And we also recognize the period of tremendous readjustment which must take place in our own country. National conditions and national ideals are entering a violent revolution rather than a slow evolution, and I sincerely trust that the very constructive program suggested by you will receive serious consideration and prompt action on the part of the government; for the problems involved are not merely national, but world problems, and individual thinking by individual business men is hopeless—the nation must think and plan as a nation."

From the great merchandising house of William Filene Sons Company, Boston, this letter, signed by Edward A. Filene, its president, who is chairman of the war shipping committee of the Chamber of Commerce of the United States, has been received:

"If the bulk of the reconstruction planning is left to separate classes and interests, we shall come to the end of the war with a series of reconstruction programs. Business will have a program; labor will have a program; agricultural interests will have a program; banking interests will have a program; socialists and holders of related theories will have a program. And at the very moment when unity of purpose and promptness of action will be vital to the welfare of the country we shall be obliged to pay the price of costly delay incident to the harmonizing of these several programs.

"It is clearly the wise policy to create a government commission so thoroughly representative of all classes and interests that it will command the support of all classes and interests. If such a commission collates its facts, formulates its conclusions, and submits them in advance to the most exhaustive criticism from all possible angles, we shall be able to get most of the work of compromise out of the way by the end of the war and arrive at the time of action with a unity of purpose and policy otherwise impossible.

"I realize the question of tactics and timeliness involved in any proposal to-day not related to the immediate job of prosecuting the war; and yet the war will end some day, and whether that time be one year or twenty years from now, the time will be none too long for the analysis of the complicated problems that underlie the return of our social, industrial and political life from a war basis."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

A. I. and S. E. E., Philadelphia Section. — On June 15 the Philadelphia Section of the Association of Iron and Steel Electrical Engineers held its annual outing at Valley Forge with sightseeing and athletic sports.

Electrical League of Cleveland.—H. L. Schneider was elected president, Mathias Turner vice-president, George S. Crane treasurer and L. J. Darrah secretary at the meeting of the board of directors of the Electrical League of Cleveland on June 10.

A. I. and S. E. E., Pittsburgh Section.—H. L. Uhland, power and mining engineering department of the General Electric Company, will read a paper on "Electric Welding" before the regular meeting of the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers at the Hotel Chatham to-day (June 22). The paper will deal with electric welding opportunities.

British Columbia Association of Electrical Contractors and Dealers.—On June 4 the British Columbia Association of Electrical Contractors and Dealers held a regular monthly meeting in Vancouver, B. C. President C. E. E. Williams was in the chair. Capt. W. J. Conway of Vancouver was made secretary-treasurer. The next annual meeting will be held in Victoria about the middle of August.

New York Jovian League.—At the annual outing of the New York Jovian League at the Hotel Shelburne, Brighton Beach, it was shown that a good time could be had and a good dinner enjoyed without going against the wishes of the Food Administration. When the rejuvenation was held four men were initiated by First Tribune G. V. W. Piez. Among the entertainment features were the "review" and dancing.

American Society for Testing Materials.—The twenty-first annual meeting of the American Society for Testing Materials will be held at Atlantic City, N. J., June 25 to 28, at the Hotel Traymore. Among the important items on the program are the report of the committee on magnetic properties of steel, C. W. Burrows chairman; topical discussion on "Co-operation in Industrial Research"; report of committee on lubricants, C. P. Van Gundy chairman; "Internal - Cumbustion Engineering—Lubrication and Lubricants," by P. H. Conradson; report of committee on refractories, A. V. Bleininger chairman; "The Necessity for Inspection and Testing of Refractory Bricks," by C. E. Nesbitt and M. L. Bell, and the report of committee on electrical insulating materials, C. E. Skinner chairman.

California Co-operative Campaign Gathering.—A "get-together" dinner under the auspices of the California Electrical Co-operative Campaign was held in San Francisco on June 7. John A. Britton, vice-president and general manager Pacific Gas & Electric Company, acted as toastmaster. Other speakers were L. H. Newbert, chairman of the advisory committee of the California Electrical Co-operative Campaign and manager of the commercial department Pacific Gas & Electric Company; H. C. Reid, president California Association of Electrical Contractors and Dealers; Samuel Kahn, president Pacific Coast Section of the National Electric Light Association; Frank R. Devlin, member California Railroad Commission; A. B. C. Dohrmann, president Dohrmann Commercial Company; S. M. Kennedy, general agent Southern California Edison Company, and Albert H. Elliott, secretary Pacific Division Electrical Supply Jobbers' Association.

New York State Association of Electrical Contractors and Dealers.—The first annual meeting of the New York State Association of Electrical Contractors and Dealers is to be held at the Grand Union Hotel, Saratoga Springs, N. Y., on June 24 and 25. Among the important papers to be presented are "The Scientific Adjustment of the Weight Scale," by L. K. Comstock; "The Responsibilities of the Electrical Press," by O. H. Caldwell, editor of *Electrical Merchandising;* "The Part of the Central Station in the Goodwin Plan," by Alexander Anderson; "The Jobber," by C. R. Russell of the Esco Electric Supply Company, Albany, N. Y.; "The Manufacturer," by J. Nelson Shreve of the Habirshaw Electric Cable Company; "Accounting Costs and Overhead," by Messrs. Coles and Watters of the Lord Electric Company, and "The Advantages of Separate Cost Planning of Different Departments," by F. A. Mott of the Wheeler-Green company, Rochester.

A. I. E. E., Detroit-Ann Arbor Section.—At the regular annual meeting of the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers W. A. Hirt, production department of the Detroit Edison Company, spoke on "Plotting for Economy." The main feature of the paper was the presentation of a method based upon elementary calculus for determining maximum efficiency of a combination of power generating units for any range of load. The deductions from analyses of input-output or so-called characteristic curves are interesting from the operating engineer's viewpoint, and it seems probable that the knowledge gained will be utilized in future design. Although the deductions made in the paper are based upon mathematical analyses and the use of graphs, the treatment of the subject has been with special regard to the necessities of daily plant operation. Empiric methods are touched upon, showing application of this method by a combination of the use of arithmetic and simple drafting methods.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Scope of Employee's Duties.—It was outside the scope of the duty of a yardmaster of a coal company in admitting an employee of a light company to inspect a meter to engage in a dispute with him relative to the demerits of their respective employers in the course of which he was provoked into killing the inspector, and on these facts appearing in an action brought against the coal company for damages because of the murder, the coal company was entitled to a peremptory instruction, according to the Supreme Court of Tennessee (202 S. W. 935).

Contributory Negligence. — Where plaintiff's intestate, while climbing a pole to remove a wire for his employer, came into contact with defendant's defectively insulated high-voltage wire, which passed about eight inches from the pole, and was killed, the fact that deceased was not wearing rubber gloves, as required by his employer, when within reach of live wires, does not constitute contributory negligence as a matter of law, according to the New York Supreme Court in Bell versus General Electric Company (170 N. Y. S. 170). Where decedent's death was caused by coming in contact with defendant's defectively insulated high-voltage wire while climbing a telephone pole for his employer and it was not proved that he grasped the wire, but from his injuries it appeared that he fell upon the wire, contributory negligence was for the jury.

Jurisdiction of Appeal from Commissioner's Decision.—On an appeal to the Circuit Court from an order of the State Public Utilities Commission authorizing a change of telephone rates, where the chairman of the commission, being present in court, refused to file a transcript of the proceedings, the court had jurisdiction of his person, and could punish him for contempt, the Supreme Court of Illinois held (119 N. E. 423). Where the commission has entered an order authorizing a telephone company to change its rates and the city has appealed therefrom, jurisdiction is conferred on the Circuit Court under direct statutory provision to hear and determine the matter of the appeal, when a copy of the notice of appeal, with proof of service, is filed with the clerk. In an appeal from an order of the commission authorizing a telephone company to change its rates the transcript of the commission is essential under the law, provided that no new or additional evidence be introduced in any proceeding on appeal from any decision or order of the commission, but that the appeal is heard on the record thereof.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Coal Cost and Rates.—In allowing the Seymour Electric Company to increase rates the Wisconsin Railroad Commission held that analysis of operating performance indicated average efficiency as regards coal consumption, that the mechanical efficiency of the utility's plant did not differ materially from other small plants in the State, and that the allowance made for labor was sufficient to provide for continuous operation as desired by the city, though should the fuel and labor situation become worse curtailment of hours of service may become necessary.

Return from Energy Sales Found Inadequate.—Deciding that the Cross Plains Electric Company should have authority to raise rates, the Wisconsin Railroad Commission held that analysis of the earnings and expenses indicates that for the year ended June 30, 1917, the company failed to earn more than 5.3 per cent on its estimated value, and that the elimination of receipts from sale of fixtures, wiring, etc., would wipe out entirely the surplus available for returns during such year. The company declared that it was losing money on farm consumers owing to transformer losses, that the greater proportion of its profits came from house wiring and sale of fixtures, a business it was no longer engaged in, and, in general, that it was losing money because its lighting and power rates were too low in proportion to the cost of doing business.

Communities Served from One System.—Approving new rates for the Wisconsin Gas & Electric Company at Union Grove, the Wisconsin Railroad Commission said in part: "The principal contention of those consumers who complained of the rates in effect for residence and commercial service was that in Corliss, a much smaller place than Union Grove, electric consumers received service from the respondent company at lower rates than those in the latter community. In regard to the practice in vogue in many parts of the State of serving all communities tied in on one transmission system at the same rates, it is apparent that unless the original rate schedules are carefully determined, the expense of serving certain communities will be borne in part by one or more of the others. If the rates in effect in Corliss are equitable for that community, then the same rates will not be sufficient to cover the operating expenses including fixed charges on delivering energy to Union Grove. At the hearing the company proposed certain rates for residence and commercial lighting service. Inasmuch as the proposed rates offer considerable reductions for even the average use of energy, we believe that they should be put into effect and given a trial."

Rate Increases in Illinois.—In an order effective from May 1 the Public Service Commission of Illinois has granted almost in its entirety the petition of the Illinois Traction System for emergency relief for electric railway, electric light and gas companies in fourteen Illinois cities. The commission allows 6-cent fares in Cairo and Jacksonville, elimination of tickets and straight 5-cent fares in Bloomington, Decatur, Danville, Champaign, Urbana, Galesburg and Quincy. Increases in rates for gas ranging from 10 to 25 cents per 1000 cu. ft. are allowed in Decatur, Danville, Champaign, Urbana, Galesburg and Jacksonville. Electric increases of approximately 1 cent a killowatt-hour are allowed in Bloomington, Galesburg, Normal, Decatur, Danville and Jacksonville, while smaller increases are allowed in Cairo and cities in which the Madison County Light & Power Company operates. The order in brief says that this is an emergency case, and that it is the duty of the commission in each case to determine what may be reasonable rates for public and utility alike. The new rates are not to remain in effect beyond six months after the termination of the war and may be rescinded before that time if the commission decrees.

War Necessities.—In its recent decision allowing 10 per cent increase in various rates of the Philadelphia Electric Company the Pennsylvania Public Service Commission said in part: "The testimony shows that the companies interested have entered upon a very large construction and extension program designed to meet the extraordinary demand for energy which has arisen in this district during the last year and a half and particularly since the declaration of war. The district served by these companies, especially by the Delaware County Electric Company, contains an unusually large number of new plants, the maximum operation of which is absolutely essential to the welfare of the country. These plants and the population dependent on them are relying upon the applicant companies for a continuous and adequate supply of energy, and it seems to this commission that its first duty is to assure the production of this energy upon terms which are reasonable to all who are concerned in it. We are convinced, however, of the necessity for increasing the rates to the extent of 20 per cent and are of the opinion that an increase of 10 per cent for the services in question will be sufficient to accomplish the ends which we have outlined above. There can be little doubt that the sales of the companies will be greatly increased during the coming year, and that certain economies in operation will be effected by the installation of the improvements which are being made. These facts, together with the 10 per cent increase we are authorizing, should assure the companies of an income sufficient to meet the increased operating expenses and leave a fair return upon the property."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Failure of Car Supply for Coal.—The Eastern Utilities Coal Company calls attention to the continued failure of coal transportation, as evidenced by conditions at its properties. The normal car supply should be at the rate of 266 cars per month, and at no time during the past seven months has the supply been 50 per cent. The actual record is as follows: November, 129 cars; December, 80 cars; January, 52 cars; February, 70 cars; March, 101 cars; April, 118 cars; May, 124 cars.

Milwaukee Wants to Increase Its Street Lighting.—An appeal will be made to the Capital Issues Committee of the Federal Reserve Board at Washington to permit the city of Milwaukee to go ahead with its municipal lighting distribution proposition. At a recent meeting of the council Alderman William I. Green said that the $250,000 approved by the committee was not sufficient to carry on the work, and he introduced a resolution asking the board to permit the entire bond issue of $500,000 to go through.

Work of Naval Consulting Board.—The Naval Consulting Board, which was created nearly three years ago, when Secretary Daniels invited Thomas A. Edison and eleven leading technical societies to nominate representatives who should constitute it, thus concentrating for service the engineering and inventive talent of the country, has up to date acted upon more than 65,000 inventions of all kinds. A special board to consider inventions for army use has recently been created, known as the inventions section of the General Staff.

Summer Courses in Electrical Engineering.—The College of the City of New York is offering at a nominal fee as part of its summer session courses in elementary electrical engineering, telegraphy and telephony. The purpose of the first course is to give a clear idea of the main underlying principles and methods of electrical engineering, the methods of constructing, installing, operating and maintaining motors and generators of various types and certain other of the simpler forms of electrical apparatus. The courses in telegraphy and telephony appeal to men seeking positions or advancement with telegraph and telephone companies and are given in co-operation with the Western Union Telegraph Company, the Western Electric Company, the New York Telephone Company, the American Telephone & Telegraph Company, the Kellogg Switchboard & Supply Company and the Automatic Electric Company. Prof. Paul Klapper is the director of the summer session of the college.

Otto J. Hawley, assistant chief engineer of the Public Service Company of Oklahoma, has resigned to go to San Francisco.

Max Thelen has resigned as chairman of the California Railroad Commission to become surveyor of contracts for the War Department at Washington.

L. V. Purtne, who was formerly chief engineer of the Public Service Company of Oklahoma at Tulsa, has been transferred to the Dallas office of the American Public Service Company.

Edward Lane, who was formerly connected with the Des Moines City Railway Company, is now in charge of the power plant of the Kansas City (Mo.) Electric Light & Power Company.

Frank E. Hanchette, who has been with the Edison Electric Illuminating Company of Brooklyn for the past six and a half years as chief electrical inspector in the operating department, has resigned and will devote his energies to the marine field under the government shipbuilding program, a line in which he has had a broad experience.

Frank Espy, former assistant to the general manager of the American Gas & Electric Company, New York, has succeeded Hugh Montgomery as general manager of the Atlantic City Electric Company. Mr. Espy was formerly general manager of the Ohio Light & Power Company, Newark, Ohio. Mr. Montgomery has been transferred to the New York office.

Charles F. Howe, consulting engineer of Macon, Ga., who has been for many years identified with the water-power development in Georgia, has been commissioned as major in charge of the public utilities at Camp McClellan, near Anniston, Ala. Major Howe was one of the first to recognize the importance of hydroelectric power to the industries of the South and was the originator of what is now known as the Central Georgia Power Company. This company has a large development on the Ocmulgee River midway between Atlanta and Macon. He was its chief engineer during the period of construction and for a number of years thereafter, and is now largely interested in other water-power developments in this and other states.

Leon C. White has been promoted from superintendent of the electric light and power department of the Twin State Gas & Electric Company, Brattleboro, Vt., to superintendent of operation of all departments in the company. Mr. White was born in Brattleboro in 1880 and received his education at the local high school and correspondence school. He first engaged in the electrical contracting business, entering the employ of the Brattleboro Gas Light Company as chief electrician in 1903. When this company was purchased by the Twin State Gas & Electric Company in 1906 he was appointed superintendent of the electric light department, which position he occupied until he was recently placed in charge of the electric, gas and street railway departments of the company.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

William J. Hammer, consulting electrical engineer, New York City, has received the commission of major in the National Army and is stationed at the War College, Washington, D. C., in the inventions section of the war plans division of the General Staff. Major Hammer has been a consulting electrical engineer since 1889. He is a fellow and past-president of the American Institute of Electrical Engineers and has affiliations with a number of other societies.

Henry I. Harriman, president of the New England Power Company, has been re-elected president of the Boston Chamber of Commerce. Mr. Harriman's work for the chamber has been greatly appreciated during the past year, and he undertook it at considerable personal inconvenience in view of the administrative problems brought to his desk as the chief executive of the largest hydroelectric system in the Northeastern States. As it is exceptional for the head of the chamber to hold office for two successive terms, Mr. Harriman's re-election is to be regarded as high evidence of appreciation for the service rendered by him in this capacity. He has worked in close co-operation with James J. Storrow, New England Fuel Administrator, and with the executives of other public utility organizations which are doing much to conserve fuel and meet the pressing difficulties of power supply under present severe conditions. As recently stated in the ELECTRICAL WORLD, Mr. Harriman's partner, Malcolm G. Chase of Providence, R. I., has lately taken office as Federal Fuel Administrator for Rhode Island.

Obituary

Charles R. McKay, consulting engineer for the Union Gas & Electric Company, Cincinnati, Ohio, was instantly killed on May 14 in an automobile accident near Cincinnati. Mr. McKay was graduated from Johns Hopkins University, Baltimore, in 1893. He was first engaged as construction engineer for the Pioneer Power Company of Utah and for the Ontario & Daly Silver Mining Company of Utah. During the time he was thus engaged he also served as a member of the Board of Electrical Award of the Chicago World's Fair. He came East as superintendent of the Sprague Electric Elevator Company and later became chief engineer of the Sprague Electric Company. In 1900 he went to Cincinnati as district engineer for the General Electric Company, remaining until 1907, when he became manager of the electrical and gas departments of the Toledo Railways & Light Company. Two years later he became manager of the Union Light, Heat & Power Company at Covington, Ky., and on the consolidation of this company and the Union Gas & Electric Company of Cincinnati he became manager of the lighting department and chief engineer of the parent company. About a year ago he resigned to devote his entire time to the duties of chief electrical engineer of the construction of the new power plant in Cincinnati. In 1908 he was elected president of the Ohio Electric Light Association, and at one time he was chairman of the Toledo Section of the American Institute of Electrical Engineers.

William Johnson Jenks, electrical engineer and a recognized leader among patent experts in this country, died at West Bridgewater, Mass., at the age of sixty-five, on June 1, after an illness extending over several years. Mr. Jenks was one of the organizers of the library of the A. I. E. E., which now forms a part of the library of the United Engineering Societies, and served for many years on the library committee. He was educated at Pierce Academy, Middleboro, Mass., and began his business career as a newspaper reporter on the Brockton *Advance.* He became a telegraph operator in 1872, from which date he was continuously engaged in electrical work. From 1878 to 1883 he developed and managed at Brockton one of the early telephone exchanges. From 1883 to 1885 he was associated with the Edison Electric Illuminating Company of Brockton as manager. This Brockton plant was the pioneer Edison three-wire underground installation in the history of the electric lighting art. In July, 1885, he accepted the position of manager of the incandescent department of the American Electric Manufacturing Company, with headquarters at New York City, and in October of that year started the first Edison "municipal" system for the lighting of streets by incandescent lamps and Edison dynamos of 1000 volts to 1200 volts at Portland, Me. This was in many respects a new departure in electric lighting. In the summer of 1886 he was engaged by the Edison Electric Light Company as manager of its municipal department, and in the course of the succeeding three years he gave considerable attention to working out the details of this system of high-tension incandescent street lighting. He was also appointed director of the standardizing bureau of the Edison company, and in that capacity assisted in perfecting the methods of distribution and the apparatus manufactured and sold by the Edison factories. From about Sept. 1, 1889, until his last illness he gave practically his entire time to the patent litigation carried on by the Edison Electric Light Company, the General Electric Company and associated electrical patent interests. In addition to his membership in the American Institute of Electrical Engineers he was connected with many other of the engineering and scientific societies.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

CHANGES MADE IN HOSKINS HEATING APPLIANCE SCHEDULE

The Best Discounts That Are Enjoyed by Any Particular Class of Trade Are Given to the Federal Government

A number of changes in the Hoskins schedule on domestic electric heating devices go into effect on July 15. The changes in price are mostly increases, although a decrease from $7.50 to $6 goes into effect on 3½-lb. to 6½-lb. plain base multiple-heat irons.

The misunderstanding that has arisen so many times regarding vertical toasters has been cleared up so that those without rack will list at $5 while those with rack will list at $5.50. Grills advance from 50 cents to a dollar, according to type. Radiant radiators advance on the 660 watts or less sizes from $7.50 to $8.50.

Provisions are made in the new schedule for maximum discounts to the government on all appliances. Formerly the government enjoyed a smaller discount than the central stations. Now, however, where the material is billed direct to the government the discount is 42, 3, 2, 2 net, on appliances, and 25, 10, 10, 5 and 2 net on ranges.

Provision also is made under the new schedule for allowances on returned merchandise. A manufacturer after July 15 may take an obsolete appliance of his own make, sold prior to Oct. 15, 1915, in exchange, provided that it is taken in exchange for a device which has at the time superseded the one returned and that he makes an allowance for the returned device not greater than 10 per cent discount from the net price at which the new device taken in exchange is sold to that particular customer. It is further provided that no advertising or other intensive selling campaign shall be based on this exchange proposition.

A paragraph is added explaining the position of a holding company and how it can operate under the schedule.

RESTRICTIONS TO BE PLACED ON JOBBERS' STEEL STOCKS

As a Result of Conference with War Industries Board Jobbers Will Make Regular Monthly Reports

To what extent jobbers' stocks should be protected by the government has been receiving the attention of the War Industries Board. It is well known that jobbers, particularly those engaged in the electric supplies business, have depleted their stocks repeatedly on government orders without being able to obtain priorities for replenishment.

A meeting to discuss this situation was held on June 13 in Washington by the War Industries Board, which hardware, machinery, pipe and affiliated jobbers were invited to attend. As a result a committee probably will be appointed to supervise and apportion steel for jobbers' stocks.

After the meeting on June 13 the War Industries Board authorized the following:

"Representatives of the board have been in conference this afternoon with representatives of jobbers in hardware, machinery and kindred lines. Fifty or more men from all branches of the trade were present, representing all the large organizations in the trade, large individual concerns and some affiliated lines. The trade pledged full and hearty co-operation with whatever the board might request. Specific suggestions were volunteered by the trade for directing the flow of stocks into essential uses.

"Special consideration was given to the subject of organizing a small committee to represent all branches of the trade and all sections of the country and to sit in conference with the Priorities Committee, the Director of Steel Supply and other officials of the War Industries Board needing its advice or assistance in apportioning steel to hardware jobbers or in maintaining, increasing or reducing dealers' stocks. This plan was favorably received, and it seems probable that it will be put into effect by the industry as a whole.

"A form for monthly reports by jobbers of the quantities sold of the several classes of goods handled was placed before the meeting by the Director of Steel Supply, together with another form on which should be reported orders placed with mills during the same period. The jobbers will undertake to know accurately the uses to which goods distributed by them are to be put and to discourage the undertaking of work not immediately essential, the postponement of which will help to relieve the non-war demands for iron and steel. It is anticipated that this report system can be put into effect to cover from June 1 on, thus furnishing the Director of Steel Supply and the Priorities Commissioner with monthly figures which will be of material assistance in their work."

EASIER CONDITIONS OF LAMP STOCK CONSIGNMENTS

Certain Producers Working on Quantity Production Basis Are Now Urging Distributers to Increase Local Supply

Ever since the distribution of incandescent lamps has been on a consignment basis manufacturers have worked on the maximum customer turnover basis. With a comfortable stock on hand manufacturing thus kept pace with demands which, except for seasonal variations, were fairly constant.

Two years ago this policy was carried still further, and consignees were not allowed to amass a stock larger than necessary to take care of their immediate requirements. The increased demand and the inability of the producers to meet it so seriously reduced stocks that this measure was resorted to.

Since that time, however, the situation generally has cleared considerably, and as a result the policy of producers in regard to stock limitations has in certain instances had a complete reversal. Some producers now encourage distributers to take as many lamps as they can find storage place for locally. The intention of these producers is to amass as large stocks about the country as is possible.

Evidences are seen of a heavy lamp demand coming this winter, and precautions are now being taken where possible to anticipate this condition with adequate stocks. Furthermore, these producers are imbued with the quantity production idea and believe that the factory must run at its maximum capacity even though a surplus accumulates. This is the way, it is felt, to keep the cost of production down to a minimum.

One concern whose output is an influential factor in the market stated that it had not accumulated any great stocks excepting on standard sizes and types. Surprise was expressed to hear that any factory had a surplus. On miniature and auto lamps the admission was general that the factories are still far behind in filling orders. The government's orders are taking a great deal of the output. Therefore it was impossible to say, if present conditions continue, when they could meet the full requirements of the trade. With these producers no larger stocks or extended time

could or would be given any one. If actual needs can be taken care of and shortages avoided, it is the best that can be done.

In the case of a manufacturer who specializes on standards only, it was ascertained deliveries were behind three and four months. This company works on the two and three months' arrangement. Instead of increasing or distributing a large quantity of lamps it was drawing in or scaling down stocks which were carefully watched and regular reports on this condition insisted upon. This company also stated that while it was increasing its production, which was due to the time of year, one of its plants at least would be shut down the first two weeks in July to overhaul the factory and give the employees a vacation. It was learned that some companies were not able to provide jobbers and dealers with more than a two months' stock of lamps. They had not caught up as yet with the requirements of their trade, consequently no stronger stocks could be furnished.

THE WEEK
IN TRADE

EVERYWHERE the demand for electrical supplies is of substantial proportions in spite of the maintenance of prices at the present high levels. The peak, of which so much was heard only recently, the line that few believed would be passed, is being ignored. Advances on not a few lines still continue to be made, and no one seems to know how high the figures will go. It is certain that jobbers whenever possible are accumulating stocks on staples, anticipating heavy sales, if not in the immediate future, at least not far distant.

Conduit conditions are very unsatisfactory. The situation is approaching a very acute stage. Standard sizes are depleted and shipments are overdue. The supply of motor fans, particularly in certain sizes, is undoubtedly short and in the East is causing anxiety. West and South stocks are reported as adequate. In New England the movement of washing machines is active and stocks are getting low. On the Pacific Coast industrial material is in lively demand. The new prices on heating appliances go into effect July 15.

The labor shortage is being severely felt in all parts of the country. In the Pacific Northwest the so-called "work or fight" order is stripping jobbers and dealers of necessary employees. Building operations in the same section, particularly residential, are passing all records. In the South large industrial enterprises, calling for important electrical equipment, are on foot. Collections are fairly good, keeping pace with sales, and outstanding accounts are being considerably reduced.

NEW YORK

An advancing market always brings surprises, and current conditions would seem to be no exception. Stocks are of various sizes on heavy staples. Some jobbers are in an enviable position, and others are wondering what will happen next. For example, in certain lines buying has been of the anticipatory order, and where foresight tempered with judgment was exercised the accumulation of much-needed goods in a few hands is one of the surprises. It is said some large distributers, having a line on the market for salable merchandise, parted with their holdings at what was considered a sacrifice, in order to make a quick turn—to their regret now. Others, looking a little farther, still hold their stocks.

Some further changes in prices are reported. Difficulties of getting goods for future operations are growing more serious. Transportation obstacles prevail to an alarming extent, with the embargoes more frequent and not lifting so frequently. Between Philadelphia and New York and intermediate points delivery delays are very frequent.

Financially the trade is sound. Collections from commercial accounts are quite good. No breach in credit firmness is noticeable.

PORCELAIN.—Shipments are coming in slowly and stocks are rapidly absorbed. Orders on delivery for four weeks from Trenton, N. J., have not yet arrived. The embargoes are more restrictive in this stretch of territory, it is said, than anywhere else.

FANS.—There are evidences locally that the supply of 12-in. and 16-in. fans is scant. One manufacturer is sold up on his output; a second is in bad shape for contract deliverance, goods promised in March just coming through. One of the largest fan-distributing firms, particularly in the smaller sizes, will have its output curtailed 40 per cent owing to factory conditions. Some others are just about cleaned out, as material is said to be unobtainable for further production.

INDUSTRIAL LIGHTING FIXTURES.—The demand is brisk and the selling movement active. An advance of about 10 per cent was made within the past month.

HOUSEHOLD SPECIALTIES.—The advance of at least $1.25 on sewing machines to the trade goes into effect July 1. This means a retail price increase of $2.

LOCUST PINS.—Within a month or so locust pins have been marked up by $4 on 100 to 500 lots, and lots of 1000 by a trifle over $5. There is apparently an ample supply in stock, with the future uncertain.

LINE HARDWARE.—All malleable iron, japanned and galvanized brackets were advanced from 10 to 15 per cent on June 5. Malleable iron brackets are difficult to get.

COVERED WIRE.—Deliveries on No. 14 wire from a nearby plant are delayed weeks at a time and this is said to be affecting selling conditions on this number. No further increase is noted on rubber-covered and weatherproof.

HEATING APPLIANCES.—One of the leading distributers is sending out advisory notices to the trade respecting next winter's expected shortage of fuel and gas. It is therefore self-evident, according to this high authority, that ample stocks of plate warmers, grills and radiators should be provided to meet the anticipated emergency.

COLLECTIONS AND CREDITS.—On government accounts collections are prompt. Commercial bills, nevertheless, are quite good. Credits receive rigorous treatment, and little disposition is shown to be lenient on business suggestions of any risk.

CHICAGO

Another shell plant has been authorized for Chicago by the government. This news is viewed with considerable interest by the local trade, particularly at this time, as it comes simultaneously with a report from the Illinois Manufacturers' Association that 200 small factories have been forced to shut down because of lack of steel. The general situation in steel is occupying a great deal of attention in the trade. The report which J. L. Replogle sent to the steel mills stating that the steel supply committee of the War Industries Board is not concerned about any one getting steel except the plants engaged in government work, in which case priority orders are issued, seems to have covered the situation rather fully. At the present time there is also an undercurrent of agitation on the difficulties of public utility financing. Important bankers in this section are taking an active interest in the situation, and the belief seems to be that some method will be found for permitting utilities to secure relief either by means of increased rates or otherwise. Definite talk about higher traction fares in the city of Chicago is reported daily in the newspapers. Electrical supply jobbers report that business has improved during the last week. There have been practically no changes in prices, although it appears certain that the coming two or three weeks will supply numerous examples of this. While the jobbers are fully aware of this situation, their customers do not appear to be taking advantage of the present opportunity to get in stock before the increases. Telephone companies are the one exception.

CONDUIT.—The jobbers foresee a situation wherein conduit is going to be impossible to get excepting for actual government needs.

FANS.—The spell of hot weather during the last week was not of long enough duration to produce much movement in fans, but no one is despairing of the situation yet. A little hot weather, however, would be welcomed.

SCHEDULE MATERIAL.—While the jobbers were pretty well protected on the recent advance in schedule materials, their customers were not. The old policy of informing all customers in advance of price increases seems to be rapidly dying out among the jobbers.

RESALE GOODS.—Jobbers' stocks of resale merchandise appear to be good, with the exception of washing machines. Manufacturers' deliveries to the jobbers are poor, however, and give promise of being worse.

OFFICE EQUIPMENT.—Such office accessories as telephone brackets, push-buttons for buzzer systems and goods of this class have exceeded the capacity of the factories.

ELECTRIC RANGES.—The total volume of business in electric ranges to date for 1918 is about the same as for the preceding year, with an exceptionally good prospect for exceeding last year's record when all the returns are in.

BOSTON

The volume of trade continues to be maintained at a high level, and thus far there is little evidence of a summer recession. May was a particularly good month for local jobbers. Railroad congestion still hampers deliveries, and until some of the new locomotives and cars ordered by the federal authorities get into service little improvement is anticipated. Central stations are overwhelmed with war work, but are doing almost nothing in the way of commercial expansion unless related to war supplies. Small appliances are in considerable demand, and there is an improvement in the sale of portable lamps within the past fortnight. Collections are fairly good at present and are apparently unaffected by the war savings stamp campaign, an entirely different matter, of course, from the Liberty bond campaign work.

Stocks are understood to be large at present, owing to the vigorous efforts of the jobbers to anticipate demands and keep ahead of the transportation situation. Labor conditions are unsettled at this writing, a strike of electrical workers having been called in the Boston district in direct violation of an agreement to stand by the finding of H. B. Endicott, chairman of the Massachusetts Food Administration. The central stations are maintaining their service without interruption. A 10 per cent increase in the pay of hour and piece workers goes into effect July 1 at the Lynn factories of the General Electric Company. Recent price changes include an advance of 8 per cent in electric loading machines built by the Conant Machine Company, Concord Junction, Mass., and a 10 per cent advance on Century motors.

FARM LIGHTING SETS.—Business is brisk and a larger turnover is expected this year than last. Prices have shown no change since March. Stocks are prepared for prompt shipment. One dealer has two carloads of sets in his basement and three more on the way, while the factory has material enough on hand at this time for the production of 50,000 sets.

FANS.—Cool weather still holds back the flow of fans to the consumer's sockets. Unless a hot spell comes soon this year's business may run below anticipated totals. The psychological effect of a hot wave in late May or early June is much better for fan sales than warm spells in midsummer. Sales are being made to Chinese laundries, though these were held up for some time by the price increases of this year. Stocks are ample for the present.

WASHING MACHINES.—These are selling very rapidly. One of the largest central stations in New England has sold out its entire stock and is now drawing upon consigned machines.

PORTABLE LAMPS.—A spurt in retail demand has developed within the past fortnight. Practically all the business is renovation work in fixtures. Stocks are very large. Prices are being shaded in some cases to capture summer business, but the results are not as yet very satisfactory.

WIRE AND CABLE.—Stocks are fairly large up to 500,000-circ. mil cable, rubber-covered, with quotations around 32 cents per pound. Weatherproof is quoted around 30 cents. Most of the business is governmental. Little change in prices is quoted.

TRANSFORMERS.—From 10-kw. up stocks are uneven. A 10 per cent advance went into effect June 7 on the leading makes of transformers. Deliveries are being quoted on a three to five months' basis.

ATLANTA

Government requirements and news emanating from Washington are the foreshadowing features in trade this week. The agreement reached between the War Industries Board and the American Iron and Steel Institute virtually places the steel market in the hands of the government. Terms provide that no iron or steel products shall be distributed except in order of urgency as prescribed by the board and after the preferred industries have been served. The out-turn of pig iron recorded for May looks encouraging, being the second largest in the history of the country. The outlook for building operations along normal commercial channels is not so bright, and this class of construction is being further subordinated to more urgent work owing to the scarcity of steel, together with the fact that the government is absorbing about 80 per cent of the cement.

Recent estimates place coal production as falling behind the national demand by approximately 467,000 tons per day. This condition, no doubt, will influence the Fuel Administration to the extent that the long-expected "white list" will be published soon covering essential and so-called non-essential industries. A feeling of uneasiness prevails in this section regarding this measure.

Opinions from men in the electrical industry indicate a still greater demand on hydroelectric companies and a flurry for electric heating appliances such as occurred during last winter. As the East is turning out large quantities of war goods and the freight situation is becoming more serious, it is of considerable interest to note rumors in circulation to the effect that facilities offered by the Southeast will be drawn upon more from now on.

The Doullut & Williams Shipbuilding Company of New Orleans, La., has been organized with a capital of $1,000,000 for the construction of steel ships. The Consumers' Dye Wood Products Corporation, Mobile, Ala., will erect a plant with a capacity of 1800 bbl. monthly. The Central of Georgia Railway, Macon, Ga., will install a complete electric interlocking signal system. Bertram, Griscom & Company of Philadelphia, bankers, are representing capitalists interested in the Carolina-Tennessee Power Company of Cherokee County, N. C., near the Tennessee line. It is proposed to build a hydroelectric plant on the Hiawassee River developing 60,000 hp. Details are lacking at this time, but preliminary plans call for two dams 150 ft. high thirteen miles apart.

CONDUIT.—The scarcity of conduit is being felt and stocks of ½-in. are badly depleted. A few large shipments for urgent work are long overdue. Although ¾-in. and 1-in. stocks are in better shape, jobbers are exercising considerable caution and scrutinizing all orders carefully.

FANS.—While the movement of fans has been fairly satisfactory, more temperate weather has tended to slow up the feverish demand of last week. The 16-in. is the most popular for general service. Jobbers report substantial sales of ceiling fans to military camps for mess halls and offices. A few jobbers are having railroad troubles and are behind on deliveries of 12-in. and 16-in. sizes.

TEXTILE MOTORS.—Manufacturers state that sales for the first quarter of this year were well above the same period last year and that the volume of business to July 1 will be as good as last year. Better shipments are being promised and excellent deliveries are being made on the four-frame type. Local stocks are in much better shape. This condition is due to improved factory facilities. Business seems to be sustained through the purchase of replacement equipment and individual motors for looms where additions are being made.

SEATTLE

There were no exceptionally large sales or inquiries of importance during the past week and general business conditions continue unaltered. The volume of commercial and domestic sales is well sustained. The volume to the shipyards and industrials shows an increase over the last two weeks and the government buying was a shade heavier. Generally stocks are in a fair condition, although there are shortages reported on some lines, especially in conduit, larger sized lamps and automobile lamps. The latter are practically impossible to obtain. Small motors and larger power apparatus demands are being met. Deliveries from the East are very slow and orders are being placed far in advance. Placing orders in advance holds true in the case of all stocks, accounting for the fair condition of jobbers' stocks. There are slight fluctuations in prices. To-day finds prices steady and at levels reported for a month past.

Labor shortage is affecting all lines seriously. The "work or fight" order is stripping both jobbers and retail houses. It is impossible to obtain warehousemen, male clerks and stenographers. Furthermore, it is believed the order will serve to relieve somewhat the shortage in the shipyards and lumber camps.

Sales to jobbers and dealers are of small consequence. The municipal lighting department of Tacoma will shortly call for bids for furnishing approximately $20,000 worth of energy-consuming devices, including ranges, water heaters and electric heaters. The number of permits for electrical installations last week shows an increase of considerable proportions over the last three weeks in Seattle and Tacoma. The installation of electric ranges in apartment houses is increasing. Sales of house-wiring devices, including fixtures are increasing over the last two weeks.

The Northwest general contractors predict that the building peak will not be reached until midsummer or early fall. From present indications the summer months will see a volume of residence construction never equalled in the history of the Northwest cities. Constructional activity is not confined to the larger cities, as the smaller towns are building in proportion to the size and needs, which are constantly increasing.

Spruce production in the Olympia peninsula for airplane stock is to be increased by the construction of a mill with a daily capacity of fifty carloads. Initial construction has been started. Credits placed with the new shipyards and allied industrial plants are closely scrutinized. The extension of old credits predominates, but new credits of considerable proportions were placed recently. Collections are satisfactory and keeping pace with sales.

SAN FRANCISCO

Business continues good, though noticeably better in country districts and in the interior cities than in the large coast cities.

New packing plants are being erected in Mountain View and Livingston, Cal., and a new cotton reduction plant in Tucson, Ariz. Counter sales are rather poor. Sales of house-wiring material have picked up slightly. Sales of industrial material are large and of continually increasing quantities, so that constant revision of stock standards is necessary.

Collections are better than they have been this year, not only from dealers, but from industrial plants, which were slower than one might expect during the first few months of the year.

FANS.—The first real hot weather of the year, recorded at 100 deg. through the interior valleys and nearly as high along the coast, has stimulated fan business, which up to this time has not been extraordinarily good. Intensive work by dealers among plants recently erected in their territory will no doubt add to its volume. One San Francisco jobber reports an extremely large order of fans for export to Japan.

HEATING MATERIAL.—Sales of small heating devices are poor, the number of flatirons sold being far less than normal during April, which is usually a good iron month. Sales of other devices are slow, probably because of their comparatively high first cost, due to recent advances, and the feeling of personal retrenchment engendered by recent war-time demands.

PORCELAIN MATERIAL.—An investigation of stocks and demands for the first few months of this year, compared with the corresponding period of last year, discloses the fact that sales of standard porcelain material, such as split knobs, 3-in. tubes and standard two-wire and three-wire cleats, has fallen off from 50 to 67 per cent owing primarily to the lack of building calling for such wiring. There is very little house building in the country districts, and the factory building specifications are up to date and protective. The government has been doing very little fire-protection construction in the forests this year, and this fact has affected the sale of certain standardized porcelain material.

SCHEDULE MATERIAL.—As before noted, schedule material is advancing in price, because of increased freight rates and increased cost of raw material and labor necessary for assembling it. The latest items to be affected are flush receptacles and parts, which have just advanced 10 per cent for Pacific Coast delivery. Manufacturers who carried Pacific Coast stocks report peculiar demands, especially in the piece parts of separately packed sockets and receptacles, showing that jobbers and dealers are not yet familiar with the possibilities of this plan and are correcting their stocks after a few months' experience under the new condition. This is especially true of brass caps, the demand for which is all out of proportion to the bases.

METAL MARKET SITUATION

Copper Requirements for Wire Manufacturers Hard to Obtain on Commercial Orders

Wire producers are finding it difficult to obtain copper, excepting on priority certificates for direct or indirect war work. The capacity of about every wire plant is largely taken up with government requirements, and when it comes to commercial orders the obstacles in obtaining the basic metal for rubber-covered, cable and weatherproof and other wire products are reported to be trying. Sellers of copper are evidently paying slight attention to civilian demands. Deliveries to seaboard points have not improved. One shipment of five cars of copper took more than five weeks to reach New York from Baltimore.

Copper producers and refiners are scheduled to meet with the War Industries Board again on Aug. 7 to discuss the price situation. They contend that their interests have not received fair treatment in having the official price of 23½ cents a pound reaffirmed until Aug. 15. It is said that if the copper people cannot convince the board of the justness of their claim they may decide it to be advisable to take the matter to the courts for a decision.

Lead is advancing and the demand is strong. An effort is being made to avoid any further rise in prices; otherwise the government may find it necessary to step in and regulate affairs on an equitable basis. Tin is receding in price. The changes in old metals are trifling, with zinc scrap showing a tendency to stiffen a shade on price.

NEW YORK METAL MARKET PRICES

	June 10	June 17
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23 50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	26.25	26.25
Lead, trust price	7.25	7.82½
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt. price 15.00	Govt. price 15.00
Spelter, spot	7.60 to 7.65	8.07½
Tin, Chinese*	0.90	0.90
Aluminum, 98 to 99 per cent.	Govt. price †33.00	Govt. price †33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.50 to 13.75	13.50 to 13.75
Brass, light	10.50 to 11.00	10 50 to 11.00
Lead, heavy	6.00 to 6.25	6.25 to 6.50
Zinc, old scrap	5.50 to 5.75	6.00 to 6.12½

*No Straits offering. †In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to + 15%
Coil to 1000 ft.	10% to 15%
	No. 12 Solid
Less than coil	List to + 15%
Coil to 1000 ft.	10% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	List to $120.00
Coil to 1000 ft.	15% to $100.00
	No. 12 Solid
Less than coil	List to + 15%
Coil to 1000 ft.	5% to 10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft.	15% to + 10%
	No. 12 Solid
Less than coil	15% to + 10%
Coil to 1000 ft.	10% to 20%

Twin-Conductor

	No. 14 Solid
Less than coil	15% to + 10%
Coil to 1000 ft.	15%
	No 12 Solid
Less than coil	20% to + 10%
Coil to 1000 ft.	10% to 20%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+ 10% to 24.00c.
1/5 to std. pkg.	8% to 19.80c.
Std. pkg.	25% to 18.75c.

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10% to 20%
1/5 to std. pkg.	List to 20%
Std. pkg.	28% to 34%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31-.3190	.3275-.3290
Barrel lots	.285-.289	.295-.299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3175-.32	.3275-.33
Barrel lots	.2875-.29	.2975-.30

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25-50	35.00
2	25-50	45.00
2½	25-50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. s. stp.	List to $82.50	$63.75 to $67.50
⅜-in. d. stp.	$78.25 to 84.00	69.00 to 71.25
½-in. s. stp.	List to 110.00	85.00 to 90.00
½-in. d. stp.	105.00 to 112.00	92.00 to 95.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
½-in. single strip	List	$63.75
⅜-in. double strip	78.25-78.75	71.25-71.75
⅜-in. single strip	List	85.00
½-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In	List per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	25.00-$60.00	$20.50-$41.25	$20.00-$33.00
¼-in.—	$28.00-$65.00	$22.50-$45.00	$22.00-$36.00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$36.00-$55.00	$25.00	$22.50
¼-in.—	$40.00-$60.00	27.00	25.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	4% to 6.8%	7% to 10.7%
2500 to 5000 lb.	6% to 8.8%	9% to 12.7%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ in. to ½ in.	¾ to 3 in.
Less than 2500 lb.	7.3% to 8.8%	10.3% to 11.9%
2500-5000 lb.	9.3% to 10.9%	12.3% to 13.9%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to 30%
1/5 to std. pkg.	20% to 41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28% to 30%
1/5 to std. pkg.	38% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.50 to $7.00
1/5 to std. pkg.	$4.75 to $5.75

Standard packages, 500. List, each $0.07

CHICAGO

	Per to 100 Net
Less than 1/5 to std. pkg.	$7.00
1/5 to std. pkg.	5.75

Standard packages, 500. List, each $0.07

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300 watt—C	24	3.25
Round bulbs, 3½-in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾-in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4¾-in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.00 to $33.80
Coil to 1000 ft.	21.50 to 28.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft)	$29.00 to $30.00
Coil to 1000 ft.	21.50 to 25.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$21.75

CHICAGO

Net per 100	$21.75 to $30.00

OUTLET BOXES

Nos.	List per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1¼ 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	30% to 40%	20% to 35%
$10.00 to $50.00 list	35% to 50%	25% to 45%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	5% to 10%
1/5 to std. pkg.	15% to 20%
Std. pkg.	25% to 30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $38.80
1/5 to std. pkg.	14.80 to 20.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.	Std. Pkg. 4000 N.C.—Solid Nail-lt—N.C.
Less than 1/5 std. pkg.	$11.85	$20.70 to $30.75
1/5 to std. pkg.	11.10	24.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.	Std. Pkg. 4000 N.C.—Solid Nail-lt—N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10 to $11.40	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
¼-in. cap key and push sockets.	500	$0.33
¼-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+ 10%
1/5 to std. pkg.	5% to 8%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	10% to 29.70 cts.
1/5 std. pkg.	20% to 26.40 cts.

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.56
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade	Low Grade
Less than $10 list	List to + 10%	
$10 to $25 list	15% to + 10%	
$25 to $50 list	10% to 14%	
Less than $10 list		5% to 10%
$10 to $25 list		10% to 25%
$15 to $50 list		15% to 24%

DISCOUNT—CHICAGO

	High Grade	Low Grade
Less than $10 list	+ 5%	
$10 to $25 list	10% to 11%	
$25 to $50 list	14%	
Less than $10 list		5%
$10 to $25 list		16%
$25 to $50 list		24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd

DISCOUNT—NEW YORK

Less than 1/5 sctd. pkg.	10% to + 10%
1/5 to std. pkg.	5% to 20%
Std. pkg.	23% to 28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10% to + 20%
1/5 to std. pkg.	List to 20%
Std. pkg.	List to 28%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	20% to 40%	List to 30%
$2.00 to $10.00 list	10% to 50%	5% to 40%
$10.00 to $50.00 list	20% to 64%	15% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	20%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $6.00
Discount	25% to 30%

CHICAGO

List price	$5.50 to $6.00
Discount	25% to 30%

WIRE ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.42½-$0.65
No. 18, full spools	0.36 - 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.57½-$0.60
No. 18, full spools	.50- 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00-$18.00	$12.50-$13.00	$9.85-$12.50
12	23.25- 27.53	20.62- 23.26	16.13- 22.02
10	32.40- 36.47	28.65- 30.48	22.40- 22.94
8	45.70- 51.24	40.26- 42.54	31.47- 38.99
6	67.38- 81.06	61.76- 66.35	50.79- 60.30

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$18.00-$19.00	$13.00	$11.50
12	25.33-$26.28	25.33-$26.28	20.40- 20.93
10	35.04- 36.54	30.03- 31.26	28.23- 29.23
8	48.97- 51.57	41.98- 44.13	39.42- 41.23
6	66.46- 88.38	62.43- 71.61	56.39- 70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$35.25 to $37.85
25 to 50 lb.	34.25 to 37.85
50 to 100 lb.	30.40 to 37.10

CHICAGO

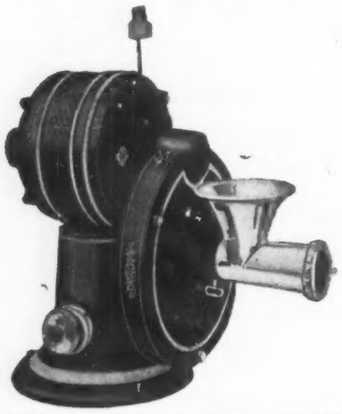
	Per 100 Lb. Net
Less than 25 lb.	$37.00 to $37.45
25 to 50 lb.	36.43
50 to 100 lb.	35.00 to 35.43

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Motor-Driven Meat and Food Chopper

A compact and easily operated motor-driven meat and food chopper has been placed upon the market by the Enterprise Manufacturing Com-



COMPACT MEAT AND FOOD CHOPPER

pany of Philadelphia. The chopper is directly connected to a ½-hp. universal motor by means of a solid shaft.

Rheostats for Motion-Picture Projection

For use in connection with a 32-volt lighting plant supplying energy for motion-picture machines illuminated by tungsten lamps, the Ward Leonard Electric Company, Mount Vernon, N. Y., has developed a low-resistance current - regulating rheostat. The tungsten lamps used with the motion-picture machines must have exactly 20 amp. flowing through them at all times

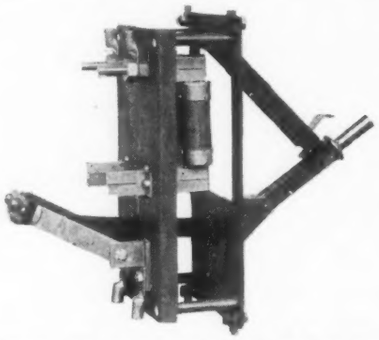
AMMETER ATTACHED TO RHEOSTAT INDICATES EXACT AMOUNT OF CURRENT

to insure the highest efficiency and longest life. In order to get this 20 amp. it is necessary to reduce the generator voltage by means of a low-resistance rheostat. The rheostat shown herewith is provided with an ammeter set at the 20-amp. point so that the operator can easily see that the rheostat's lever is in such a position at all times that the meter will register 20 amp.

The first two steps of the rheostat are of high resistance, which permits the lamp filament to heat up before the full voltage is applied, thus assuring long life to the lamp. This resistance also cuts down the current before the circuit is opened, which is accomplished by the rheostat. The rheostat and the ammeter are placed in series with the source of energy and the lamp.

Low-Tension Dead-Front Switch Panel

Owing to their high factor of safety, the dead-front panel switches manufactured by the General Electric Company of Schenectady, N. Y., are especially valuable in factories where switchboards are operated by inexperienced employees. Primarily, these



FUSES ARE NOT ACCESSIBLE WHEN THE SWITCH IS CLOSED

panels are intended as distributing panels for light and power and for generator and feeder panels for small lighting and power plants.

One switch unit, as shown in the accompanying illustration, consists chiefly of a standard knife switch and fuse-clip parts mounted on a slate base and supported by iron studs at the back of a sheet-steel panel. The operating handle has the same general appearance as an oil circuit-breaker handle and is so arranged that it is in the vertical position when the switch is "on" and at an angle of 60 deg. with the panel when the switch is in the "off" position. The operating link passes through both the steel panel and the slate base and transmits the motion from the handle to a lever attached to the cross-bar of the switch. The steel panel of the switch unit is provided with a sheet-steel door which is hinged at the top, allowing it to open upward as far as the stop on the operating handle behind which it is mounted. This door gives access to the fuses from the front of the panel but cannot be opened while the switch is "on." When this door is open the switch cannot be closed. Fuses can be inspected or replaced at any time, but the operator cannot come in contact with the live current-carrying parts, as the fuses are on the load side of the switch and the fuse clips must be dead before the fuse compartment door can be opened. The switch can be locked in the "off" position by an ordinary padlock. The capacity of the switches is limited by the sizes of 250-volt and 600-volt inclosed fuses as approved by the National Board of Fire Underwriters. Current ratings range from 60 amp. to 600 amp.

Electrically Heated Faucet That Supplies Hot Water

Hot water can be obtained almost instantaneously by means of an electrically heated faucet that is being manufactured by the Electrical Products Corporation, 6 South Calvert Street, Baltimore, Md. This device, as shown in the accompanying illustration, may be attached to any standard plumbing fixture and is ready for operation when the plug is inserted in an electric socket.

One turn of the faucet handle starts the flow of cold water, and the second

A TURN OF THE FAUCET CONNECTS THE HEATING ELEMENT TO ENERGY SOURCE

turn makes the electrical connection and heats the running water. The manufacturers claim that this device will heat 24 gal. (91 l.) per hour to a temperature between 110 deg. and 180 deg. Fahr. This faucet is adjustable

to any water pressure and can be used on either grounded or ungrounded systems of energy supply.

Crane Protective Panels

Crane panels which are used as distribution centers and also to protect the electrical equipment of the crane from abnormal conditions that may arise from overload, short circuits, grounds, voltage failures, etc., are being manufactured by the Allen Bradley Company, 495 Clinton Street, Milwaukee, Wis.

All electrical distributing and protective apparatus is mounted on one single panel and is centrally located in the crane cab. Undervoltage protection is given as well as double-pole, time-limit, overload protection for the entire equipment grouped together. The installation includes self-closing overload relays. A push-button station is used to reset magnetic clapper switches. Magnetic clapper switch limit stops for hoist in one or both directions are furnished when specified. Magnetic clapper switches for use in connection with dynamic control may also be furnished when specified. The magnetic switches are arranged for non-closing on overload.

Portable Electric Searchlight for Emergency Work

A self-contained portable searchlight operating on its own power and yet light enough in weight to be carried in the hands has been placed upon the market by the Portable Electric Searchlight Company, 87 Haverhill Street, Boston, Mass. An adjustable bracket permits of the rays being pointed in any direction and has a 7½-in. (19-cm.) adjustable-focus, single-shell reflector made with great accuracy. It burns continuously about two and one-half hours before it becomes necessary to recharge it.

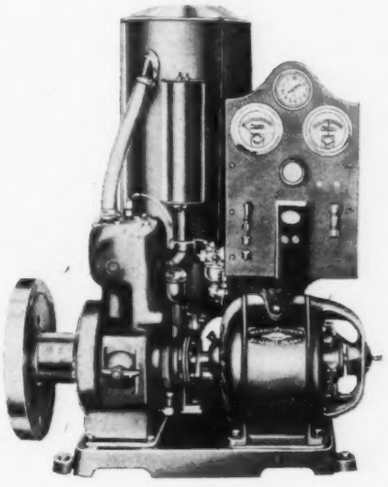
It is especially adapted for electric light companies for locating and repairing trouble on wires and poles, in manholes and for trench work, and it may be used for high-tension transmission lines and towers and for temporary construction and maintenance of outdoor substations.

FOR TEMPORARY ILLUMINATION OF OUTDOOR SUBSTATIONS

For work where it is only necessary to light up the immediate foreground the searchlight can be furnished with a wide-angle reflector which throws a very white diffused light instead of a beam.

Dual Purpose Farm Lighting Equipment

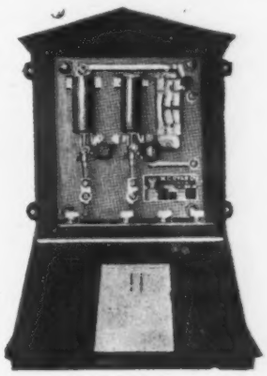
Belt power for overhead shafting and direct-connected machinery is supplied, as well as energy for charging batteries and delivering electrical energy, by the farm lighting outfit that is being manufactured by the Marron Manufacturing Company, Rock Island, Ill. The engine, generator and switchboard are all built in the Marron factory and are equipped with Edison batteries. The unit is driven by a single-cylinder vertical engine that is simple in construction and has a housing containing all movable parts. These parts are very easily accessible and may be reached by simply removing covering plates. The speed of the engine is controlled by means of a governor entirely inclosed which runs in oil. The board carries a field rheostat, a single-pole, double-throw switch on the ignition circuit, a high-grade voltmeter, an ammeter, a time switch and an automatic cut-out. The feature of the set is the automatic time switch. The batteries are charged for the time set, and the plant automatically cuts off its work. The 1.75-kw. generator is directly connected to the engine shaft by means of a flexible coupling. The over-all dimensions of this plant are 37 in. (94 cm.) long, 27 in. (69 cm.) wide and 44 in. (113 cm.) high, and the shipping weight is approximately 650 lb. (285 kg.).



FLYWHEEL MAY BE USED FOR PULLEY FOR POWER PURPOSES

Magnetic Thermo Flashers for Electric Signs

High efficiency is claimed to be the feature of a flasher operating on a thermal and magnetic principle which is marketed by the M. C. Ryan Company, Phoenix, N. Y. The thermo circuit of this flasher is independent of the sign load and does not have springs or other moving parts to get out of order. Contacts are made of a special composition of metal and carbon, ⅝ in. and ½ in. (1.58 cm. and 1.27 cm.) in diameter, respectively giving a non-welding and minimum arcing break. The thermo element has two parallel bars from the same die and stock, in order that they may expand and contract together under any climatic changes. This makes the length of the flash and its duration always uniform in times per minute regardless of the sign load. The accompanying illustration shows a two-circuit, 660-watts-per-circuit flasher mounted in steel weatherproof cabinets. The company also manufactures a four-switch flasher, but this is not mounted in a cabinet.



TWO-CIRCUIT FLASHER MOUNTED IN WEATHERPROOF CABINET

Rectifier for Charging Storage Batteries

Both the positive and the negative halves of the alternating-current wave are rectified into a steady unidirectional charging current by means of a full-wave magnetic rectifier that is being manufactured by the France Manufacturing Company of Cleveland, Ohio. This device consists of a vibrating rectifier mounted with a variable carbon resistance unit. The device is especially adapted for charging automobile batteries and may be fitted into an ordinary lamp socket. An ammeter is supplied with the device to indicate the rate of charging.

FULL-WAVE MAGNETIC RECTIFIER

Inclosed Rheostat for Garages

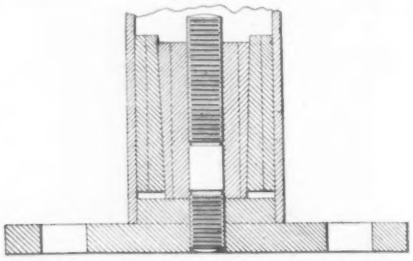
An interlocking overload and underload release circuit breaker is the feature of a "Universal" rheostat that has been placed upon the market by the Ward Leonard Electric Company of Mount Vernon, N. Y. The overload circuit breaker protects the rheostat, the battery and the entire circuit against excessive current. The underload circuit breaker prevents the battery from

BATTERY CONTROLLED BY OVERLOAD AND UNDERLOAD CIRCUIT BREAKER

discharging back into the lines. The rheostat lever and the circuit breaker are so interlocked that when the circuit breaker is open it is necessary to move the rheostat in a position of minimum charging rate in order to close the circuit. The circuit breaker is entirely inclosed so that it cannot be tampered with by the operator.

Threadless Pipe Fitting

Threading of pipes for use on switch and bus structures is entirely eliminated by means of a rigid and neat-appearing framework fitting that is being marketed by the Railway & Power Engineering Corporation, Ltd., Canadian Pacific Railway Building, Toronto, Canada. A floor flange, shown in the accompanying illustration, consists of a flat casting about 0.375 in. (9.5 mm.) thick, in the center of which is a boss of suitable diameter to fit neatly inside the pipe. A threaded stud is secured in the center of this boss. A triangular wedge with the point toward the flange is attached to this stud. Three small wedges of suitable dimensions and with their outer side curved to the inside diameter of the pipe are placed against



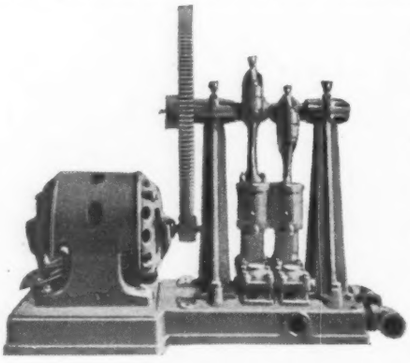
END OF PIPE HELD FIRMLY AGAINST FLOOR FLANGE

the triangular wedge, the group being then inserted inside the pipe.

A slight movement tending to draw the wedges out of the pipe causes the outer wedges to engage the inner wall of the pipe and the central wedge immediately locks. The fitting is then tightened by turning the pipe or the flange which bears against the end of the pipe, thus allowing the central wedge to be drawn into close and tightly engaging contact with the outer wedges of the flange so as to force them into rigid engagement with the inner wall of the pipe. To remove the fitting from the pipe it is only necessary to give the fitting a few turns back on the pipe and to give the fitting a tap of a hammer toward the pipe. This loosens the wedges and they can then be slipped out of the pipe. This method of fastening the pipe can be applied to any fitting.

Pumps with Interchangeable Cylinders

A line of power-driven pumps that will pump from 200 gal. to 6000 gal. (757 l. to 22,711 l.) of water per hour against pressures varying from 20 lb. to 125 lb. per square inch (1.4 kg. to 8.8 kg. per sq. cm.), lifting the water from 40 ft. to 250 ft. (12.1 m. to 76.2 m.), is being manufactured by the Midvale Machine Works, Railway Exchange Building, St. Louis, Mo. Each cylinder in these pumps, the number of which ranges from two to twelve,



VALVE OPENINGS EQUAL IN SIZE TO PLUNGER AREAS

with its valve and valve chamber, is a separate and distinct interchangeable unit and can be removed in a short time without interfering with the operation of the other cylinders. This, it is claimed, is a special Midvale feature. The valve openings are equal in size to the plunger area. No packing or stuffing boxes are used. Lubrication is secured by compression grease cups on all bearings. The bases of the pumps are made of close-grained cast iron cast in one piece. The manifold is cast in the base with suction and discharge openings on two sides and one end.

Electrically Driven Grinder for Laboratory Use

For grinding samples of cottonseed cake, linseed cake, corn cake and foodstuffs of all kinds, as well as various sorts of material used in laboratories for analysis, the Bauer Brothers Company of Springfield, Ohio, has developed an electrically driven grinder. It consists of a Robbins & Myers motor with one end head replaced by the grinder mechanism which is directly connected to the motor shaft. The grinder case opens on a hinge, and all interior parts are readily accessible and easily cleaned. This allows a variety of materials to be ground in the machine without any one sample being contaminated by the others. The outfit is also used where small amounts of materials are ground continuously, and for this service it is provided with a special base which permits a constant flow of material to pass through the mill. The device over all is 24 in. (61 cm.) in height, 16 in. (41 cm.) in width and 25 in. (63 cm.) in length. The hopper is 10 in. (25 cm.) in diameter, and the plates are 8 in. (20 cm.) in diameter. The speed of the motor is 1800 r.p.m., and the total weight is 300 lb. (136 kg.). The outfits are regularly stocked with a 3-hp., 220-volt, three-phase, 60-cycle motor, but can be furnished with the two-phase or three-phase, 110, 440 or 550-volt motors if desired.

Electric-Gas Brazing Torch for Use in Shops

Sometimes it is desired to have an electric torch for annealing and hardening of small tools, brazing, heating soldering irons, heating melting pots, soldering, etc., when there is no compressed air available. To eliminate the necessity of installing an air compressor, the Tyler Manufacturing Company, 64 Pearl Street, Boston, has placed upon the market the "Bantam" electric-gas brazing torch. This device consists simply of a turbine fan driven by a motor connected to the torch, which is supplied with illuminating gas by means of a hose. All that is needed to operate this torch is a source of electric energy and a supply of gas. The torch will develop on illuminating gas a temperature of about 2300 deg. Fahr. The motor will supply a quantity of air sufficient to operate four burners like the one regularly furnished with the torch, and if the torch is equipped with

ELECTRIC MOTOR SUPPLIES ENOUGH AIR FOR FOUR BURNERS

four burners, the manufacturers claim that it will make a very complete small furnace. The device is especially adaptable for use on ships that are not equipped with compressed air. This avoids the inconvenience and delay consequent upon the use of the ordinary gasoline torch.

Trade Notes

THE BODINER ELECTRIC COMPANY of Chicago is represented in the New York territory by John H. Barker, 95 Liberty Street, New York City.

THE WAR TRADE BOARD of Washington, D. C., announces that, effective June 1, telegraph apparatus has been added to the export conservation list.

THE S. W. ELECTRIC COMPANY of New York City has been appointed sole distributer of the products of the William F. Wolff Company, manufacturer of lamp brackets.

THE BLAW-KNOX COMPANY of Pittsburgh, Pa., has removed its San Francisco office from the Rialto Building to the new office and warehouse at 528-530 Second Street. O. B. Pulis is in charge.

DUNCAN BOND of Denver, Col., has joined the sales force of the Packard Electric Company, Warren, Ohio. He will look after the business of the company in his section, with headquarters at Denver.

THE WAR TRADE BOARD of Washington. D. C., in supplement No. 3, publishes a "Cumulative Supplement to Enemy Trading List," revised, containing additions, removals and corrections from March 15 to May 17, 1918.

THE ELECTRICAL MACHINERY SALES COMPANY of Howell, Mich., has recently opened an office in the First National Bank Building of Milwaukee, Wis., to represent the Howell Electric Motors Company in Wisconsin.

CARL GOLIN has resigned as manager and treasurer of the Northwestern Storage Battery Company of Chicago and is now with the sales department of the United States Rubber Company, mechanical division, at Milwaukee, Wis.

JOHN H. BARKER of New York City, handling electrical equipment for factories, has the sole agency in the metropolitan district for the Reliance motor-driven swing saw, manufactured by the Reno-Karthor Electric Company of Cincinnati, Ohio.

THE WESTINGHOUSE LAMP COMPANY of New York City held its annual meeting of the district managers and heads of departments at the Gedney Farm Hotel, White Plains, N. Y., all last week. The sessions were of an executive nature.

THE WADSWORTH ELECTRIC MANUFACTURING COMPANY, INC., of Covington, Ky., is now incorporated under the laws of the State of Kentucky, with a capital stock of $100,000, for the purpose of manufacturing electrical appliances.

THE GEORGE T. RENKE CORPORATION of New York City has issued a booklet entitled "A Few Facts in Latin-American Export Trade," by B. Joachim. It deals specifically and informingly with trade possibilities in that part of the world.

J. P. NICKONOW, formerly with the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., and lately with the Russian Artillery Commission, has established himself at 52 Vanderbilt Avenue, New York City, as a designing and consulting engineer.

O. S. LAIR, department manager for the Western Electric Company in various cities of the United States for the last seventeen years, and for the last four years manager of the Los Angeles (Cal.) office of the company, has resigned. Mr. Lair will become associated with the W. Ross Campbell Company of Los Angeles.

THE JEFFERY-DEWITT INSULATOR COMPANY, Huntington, W. Va., which has opened its new plant at Kenova, W. Va., as announced in the ELECTRICAL WORLD for June 8, will continue the present factory at Detroit and enlarge it to meet the demands for manufacturing spark-plug porcelains and other porcelain material of that nature.

A. HUETTER, for a number of years superintendent of the Boonton (N. J.) Rubber Manufacturing Company, is now vice-president and general manager of the Premier Rubber & Insulation Company of Dayton, Ohio. The new plant of the company, completed April 1 and in operation since May 1, is a one-story brick building, 68 ft. by 100 ft., with a separate power house of its own.

THE EMIL GROSSMAN MANUFACTURING CORPORATION of Brooklyn has opened a showroom in the Buick Building, 1733 Broadway, New York City, for the transaction of export business primarily. It will have on display all of the products which the concern manufactures. The office is under the management of Sidney S. Frank. The executive offices will be continued in the Bush Terminal Building, No. 20, Brooklyn.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY of East Pittsburgh, Pa., has purchased the property, business and good will of the Krantz Manufacturing Company, Inc., of Brooklyn, N. Y., manufacturer of safety and semi-safety electrical and other devices, such as auto-lock switches, distribution panels, switchboards, floor boxes, bushings, etc. The supply department of the Westinghouse Company will act as exclusive sales agent of the products of the Krantz Manufacturing Company, whose business will be continued under its present name. H. C. Hoke of the Westinghouse company, will represent the supply department at the Krantz factory.

Trade Publications

SOCKETS, RECEPTACLES, ETC.—Pass & Seymour, Inc., Solvay, N. Y., is distributing form 1244, discount sheet effective May 18, 1918, of sockets and receptacles, etc.

SWITCHES.—The Ceco switch is described in a circular being distributed by the California Electrical Construction Company, 641 Mission Street, San Francisco, Cal.

FARM LIGHTING SYSTEMS.—The Gray Electric Company of Springfield, Ohio, is distributing bulletin D, describing and illustrating the "Ruralite" farm lighting system.

PORTABLE INSTRUMENTS. — Bulletin 46.018A, issued by the General Electric Company, Schenectady, N. Y., describes construction and specification of its portable instrument type P-8.

FUSES.—The Bussmann Manufacturing Company, St. Louis, Mo., has issued a bulletin describing and illustrating its fuses for all types of electric circuits. This includes plug fuses, cartridge fuses and auto fuses.

ELECTRICAL SUPPLIES.—Catalog 6311 of Hibbard, Spencer, Bartlett & Company, State Street Bridge, Chicago, lists a complete line of electrical specialties. Price lists of these devices are included in the catalog.

RECTIFIERS.—Bulletin 22, issued by the France Manufacturing Company of Cleveland, Ohio, illustrates and describes the use and application of its alternating-current and direct-current battery boosters and rectifiers.

PORTABLE SEARCHLIGHT.—The portable Electric Searchlight Company of 87 Haverhill Street, Boston, Mass., has issued a circular describing, illustrating and showing the use of its Bay State portable electric searchlight.

ELECTRIC COOKING.—The Edison Electric Appliance Company of Chicago has issued a bulletin giving an address by George A. Hughes on "Electricity the Nation's Conservator," which was presented before the Minnesota Electrical Association at Minneapolis on March 12.

PORCELAIN. — The Illinois Electric Porcelain Company, Macomb, Ill., has issued a catalog on electrical porcelain installations in which it features knobs, cleats, switch bases, tubes, strain insulators and telephone and electric light and power insulators for distribution voltage. The catalog contains twenty-four pages and is illustrated.

COOLING TOWERS.—The Wheeler Condenser & Engineering Company of Carteret, N. J., has issued a bulletin showing the Wheeler-Balcke cooling tower in numerous designs and capacities varying from a few thousand gallons per hour to nearly a million gallons per hour. Several pages are also devoted to Wheeler-Barnard forced-draft cooling tower. The booklet is well illustrated with actual installations.

CONDUIT FITTINGS.—The Appleton Electric Company, 218 North Jefferson Street, Chicago, is ready to distribute its new 160-page catalog covering its complete line of "unilets" and other conduit fittings. This catalog is furnished in two sizes—that is, standard electrical manufacturers' size and a convenient pocket size. This catalog contains the numbers of new fittings recently placed upon the market by this company. A feature of the catalog is the pictorial index, which facilitates the selection of fittings required for any installation. A catalog in either size will be sent upon request.

New Incorporations

THE ELECTRICAL SUPPLY & REPAIR COMPANY of Hazard, Ky., has been incorporated with a capital stock of $25,000 by C. E. Carlin, J. B. Hoe and R. L. Cornell.

THE DALLAS (TEX.) PRESTO BATTERY & SERVICE COMPANY has been incorporated with a capital stock of $5,000 by J. V. Crannell, H. J. Crannell and P. C. Vines.

THE FARMERS' ELECTRO LIGHTING CORPORATION of Aberdeen, S. D., has been incorporated with a capital stock of $25,000 by Fred P. Tosch, R. H. Garhue and Paul G. Tosch.

THE LALLEY ELECTRIC SHIFTER COMPANY of Detroit, Mich., has been incorporated with a capital stock of $25,000 by William H. Lalley, Arthur M. Botsner and Henry Kennedy.

THE WADSWORTH ELECTRIC MANUFACTURING COMPANY of Covington, Ky., has been incorporated by George Wadsworth, Harry W. Percival and Alfred Allen. The company is capitalized at $100,000.

THE TASSIN BATTERY CORPORATION of Norfolk, Va., has been incorporated with a capital stock of $45,000 to manufacture and deal in electric batteries. The officers are: C. H. Hix, president, and R. H. Baker, secretary.

THE BROOKLYN (N. Y.) ELECTRIC WELDING CORPORATION has been chartered with a capital stock of $50,000 to do a general contracting and electric welding business. The incorporators are: J. Kjerstad, H. B. Payne and J. B. Morris, 764 Court Street, Brooklyn.

THE SPRINGWATER (N. Y.) ELECTRIC LIGHT COMPANY has been incorporated by Albert W. Howe, Louis J. Hyde and Ebenezeer Robinson of Springwater, N. Y. The company is capitalized at $7,500 and proposes to generate electricity for lamps, heaters and motors.

THE NEW YORK ELECTRIC WELDING CORPORATION of Brooklyn, N. Y., has been incorporated by J. Kjerstad, H. B. Payne and J. B. Morris, 764 Court Street, Brooklyn. The company is capitalized at $25,000 and proposes to a general contracting electrical welding business.

THE PRINCETON (IND.) UTILITIES COMPANY has been chartered by James C. Johnston, Samuel T. Heston, Jacob L. Knauss and Sampel L. May. The company is capitalized at $40,000 and proposes to supply light, heat and power and water in Princeton and surrounding country.

THE HANA (HANI, H. T.) ICE & ELECTRIC COMPANY has been incorporated with a capital stock of $20,000 to generate electricity and to manufacture ice. The ice plant of the Hana Ice Works will be acquired. John Chalmers is president and G. Errett secretary and treasurer.

THE ELECTRIC EQUIPMENT COMPANY of Davenport, Iowa, has been chartered with a capital stock of $50,000 to sell and deal in electrical fixtures, etc. The officers are: J. S. Kimmel, president and treasurer; F. E. Downing, vice-president, and A. Butler, secretary and assistant treasurer.

THE MONTCLAIR (N. J.) STORAGE BATTERY COMPANY has been chartered with a capital stock of $25,000 to deal in electrical equipment and to carry on an automobile business. The incorporators are: Helen V. Chambers, Edith L. Woodhead and William J. Woodhead, all of Montclair.

THE WYOMING WATER & LIGHT COMPANY of Mullens, W. Va., has been incorporated with a capital stock of $50,000 to operate light, heat and water plants. The incorporators are: D. D. Maron, A. W. Daubensneck, D. M. Klein, N. C. Bunch, J. A. Radwan and L. R. Taylor, all of Mullens.

THE BRODY ELECTRICAL COMPANY, 586 Spring Street, West Hoboken, N. J., has been chartered with a capital stock of $10,000 to deal in electrical fixtures. The incorporators are: Abraham P. Terk of New York, N. Y.; Max Cohen, 78 New York Avenue, Union Hill, and Samuel Brody, Spring Street, Hoboken.

THE CHADBURN (SHIP) TELEGRAPH COMPANY OF AMERICA, of New York, N. Y., has been incorporated by W. P. Allen, 214 St. James Place, Brooklyn; F. A. Whitney, 50 West 121st Street, and J. L. Galey, 39 West Twenty-seventh Street, New York City. The company is capitalized at $50,000 and proposes to manufacture electrical appliances and to do a general electrical and engineering business.

New England States

EASTPORT, ME.—In the issue of May 11 an item was published stating the Eastport Electric Company, recently organized, is installing a new plant in Eastport. We are informed that this information is incorrect. The town is now served by hydroelectric power.

LOWELL, MASS.—Plans are being prepared by the Lowell Electric Light Corporation for extensions to its power plant to provide space for the installation of new boilers. The cost of the proposed improvements is estimated at $10,000.

PROVIDENCE, R. I.—The stockholders of the Narragansett Electric Lighting Company have voted to authorize $1,700,000 in securities, subject to the approval of the Federal Reserve Board. If granted the proceeds will be used to pay for improvements, already made, amounting to $600,000, and to include the new boiler house, 60,000-hp. turbine, the transmission lines to Westerly and cables to the North End and East Providence; also for additional improvements, which will include four new boilers of 600 hp. each, a 66,000-volt transmission line over the river on towers 190 ft. high, north of Fox Point and East Providence, and a transmission line from Swansea to Warren for increasing the power loads in that section.

Middle Atlantic States

BROOKLYN, N. Y.—Plans have been filed by the Kings County Lighting Company for the construction of an addition to its plant at Fifty-fifth Street and First Avenue. Contract has been awarded to P. S. Lane, 110 West Fortieth Street, New York City. The cost is estimated at about $10,000.

BUFFALO, N. Y.—Plans are under consideration by the City Council for the installation of a new electric-lighting system in Oak, Vine and Elm Streets. Arc lamps will be used.

COBLESKILL, N. Y.—Bids will be received by D. D. Frisbie, president of board of trustees, Schoharie State School of Agriculture, Agricultural Hall, State and Lodge Streets, Albany, until June 28 for construction, including heating, sanitary and electric work of home economics building at the Schoharie State School of Agriculture. Drawings and specifications, etc., may be obtained at the Department of Architecture, Capitol, Albany. Drawings and specifications may be consulted at the school at Cobleskill and at the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York.

GOUVERNEUR, N. Y.—The Village Board has renewed a contract with the Oswegatchie Light & Power Company for a period of five years for pumping the village water supply for $6,000 per year. Under the previous contract the service was furnished at $3,700 per annum.

NEW YORK, N. Y.—Arrangements are being made by the Interborough Rapid Transit Company, 165 Broadway, for a bond issue of $37,700,000 for improvements and equipment, including extensions to power plants, etc., involving an expenditure of about $2,391,000.

NEW YORK, N. Y.—The New York Edison Company, it is reported, is contemplating the construction of a large electric generating station for the Harlem River, Port Morris section, to cost about $5,000,000. The company has recently acquired a site bounded by 133rd and 134th Streets, Walnut Avenue and the East River.

OXFORD, N. Y.—Bids will be received by Mrs. Georgiana Griffith, president of the board of managers of the New York State Women's Relief Corps, Oxford, until July 3 for refrigeration plant at the New York State Women's Relief Corps Home. Drawings and specifications may be consulted at the home, Oxford, at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

ROCHESTER, N. Y.—Bids, it is reported, are being received by the Bridgeport Tool & Machine Company for the construction of a machine shop, three stories, 60 ft. by 200 ft., on Winston Road, to cost about $50,000. R. S. Byers, Chamber of Commerce Building, is architect.

FREEHOLD, N. J.—Bids will be received by the County Board of Freeholders until July 3 for power equipment, installation of electric wiring, etc., and new heating system in connection with the erection of the proposed new tuberculosis hospital for the county. A new power house will also be built at the institution. Charles H. Wyckoff is director.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

JERSEY CITY, N. J.—The Jersey City Harbor Service Corporation has applied to the City Commission for permission to build a new marine terminal and industrial plant on a tract consisting of 160 acres in the Greenville section, near the Pennsylvania Railroad terminal, to cost approximately $7,500,000. Considerable machinery and equipment will be required for the proposed plant. Walter H. Condict, 15 Exchange Place, is representative of the company.

MAY'S LANDING, N. J.—The Bethlehem Loading Company has begun work on the construction of 12 units at its new ammunition works at May's Landing, which will include a new power plant. A new village will be established at the works to be known as Belcoville. The company is affiliated with the Bethlehem Steel Company of South Bethlehem, Pa.

NEWARK, N. J.—Contract has been awarded by the Heller & Merz Company, Hamburg Place, Newark, for the construction of a new power plant, 37 ft. by 70 ft., to E. M. Waldron, Inc., 665 Broad Street, Newark.

NEWARK, N. J.—Bids are being asked by the Day Elder Motors Corporation, 161 Ogden Street, Newark, for the construction of a truck manufacturing plant, 125 ft. by 450 ft., at Colt Street and Clinton Avenue, Irvington. The company manufactures automobile trucks.

DOWNINGTOWN, PA.—Application has been made to the Public Service Commission by the Downingtown Light & Power Company for a charter to install and operate an electric plant to supply electricity for domestic and industrial use in Downingtown.

PHILADELPHIA, PA.—The Coatesville Boiler Works, Morris Building, has the contract for improvements and alterations in the boiler plant of Adolph Weicht & Sons, 730 Rising Sun Lane.

PHILADELPHIA, PA.—The committee on street railways of the City Council has reported favorably on an ordinance authorizing the Philadelphia Railway Company to build an extension from its southwestern electric railway to the Hog Island shipbuilding plant.

PHILADELPHIA, PA.—Plans have been filed and contract awarded by the St. Joseph's Academy, Chestnut Hill, near Philadelphia, for the construction of a new boiler plant at the institution at the city line and Germantown Avenue. John McShain, 1610 North Street, has the contract.

PHILADELPHIA, PA.—Bids will be received by the United States Marine Corps, Quartermaster's Department, Washington, D. C., until June 25, to be opened by the depot quartermaster, Marine Corps, 1100 South Broad Street, Philadelphia, Pa., for furnishing 50,000 ft. cotton-covered lamp cord and 2000 lb. insulated tape. Proposal blanks and other information may be obtained upon application to the above office or to depot quartermaster, Marine Corps, 1100 South Broad Street, Philadelphia, Pa.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company, it is reported, will petition the War Finance Corporation for a loan to enable it to make improvements to its plans as recommended by the Public Utilities Commission, to include the installation of two new boilers and a rotary converter.

BALTIMORE, MD.—Contract has been awarded by the Bartlett-Hayward Company, Scott and McHenry Streets, to Morrow Brothers for the erection of a one-story addition, 130 ft. by 450 ft., to cost about $300,000, and a one-story building, 130 ft. by 378 ft., to cost about $100,000.

BRADSHAW, W. VA.—The Bradshaw Coal Company of Bluefield, recently organized, has taken over the holdings of the Bradshaw Pocohontas Coal Company of McDowell County. New equipment, to cost about $75,000, will be purchased. Electricity will be secured from the Appalachian Power Company of Bluefield. C. L. Biddison of War Eagle is engineer.

MORGANTOWN, W. VA.—The West Virginia Traction & Electric Company has begun work on the erection of a new transmission system from Morgantown to Masontown to supply energy to the plant of the Elkins Coal & Coke Company.

MULLENS, W. VA.—The Wyoming Water & Light Company, recently incorporated with a capital stock of $50,000, proposes to operate an electric light, heating and water plant. Among the incorporators are D. D. Maron, D. M. Klein and L. R. Taylor, all of Mullens.

ALEXANDRIA, VA.—The War Department will erect a laundry building, equipped with machinery, at Camp Humphreys, to be located near the base hospital. It is proposed to enlarge the power house at the hospital to enable it to supply steam and power to the laundry.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 24, under specification 3077, for an electric freight elevator at the Navy Yard, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 24, under specification 2967, for improvements to power plant at the Washington Navy Yard, to cost about $36,000.

WASHINGTON, D. C.—Contracts have been awarded by the War Department to the Air Nitrates Corporation for the construction and operation of nitrate plant No. 3. The two half units of this plant will be located, one at Elizabethtown, near Cincinnati, and the other near Toledo, Ohio. Work on construction will begin at once.

WASHINGTON, D. C.—Bids will be received at the Bureau of Standards, Department of Commerce, Washington, D. C., until June 30 for performing miscellaneous electrical work during the fiscal year ending June 30, 1919. Specifications and proposal blanks may be obtained upon application to the superintendent of the mechanical plant, Bureau of Standards, Washington, D. C.

WASHINGTON, D. C.—To make extensions and improvements necessary that electric power plants may meet the demands made upon them by the war program an appropriation of $200,000,000 is to be asked of Congress. This step has been decided on by the War Industries Board in answer to the complaints of power companies in the eastern territory that finances are needed with which to expand their plants to meet the increased demand for electricity in the production of war materials. The electric power plants in the following districts are to be proposed to receive financial aid: Niagara, Pittsburgh, Philadelphia, Pa.; Wilmington, Del.; Baltimore, Md.; Newark, Camden and Burlington, N. J.; Alliance, Massillon and Canton, Ohio; Connellsville, Pa., and Claremont, N. H.

North Central States

DETROIT, MICH.—Henry Ford is reported to have acquired mill property in Southfield, together with machinery and water rights, for the purpose of supplying electricity to the foundry being erected in River Forge.

DETROIT, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 10 for the installation of two electric elevators in the United States post office and court house at Detroit. For details see Searchlight Section.

DETROIT, MICH.—Plans are being prepared for the erection of a five-story factory building, 472 ft. by 66 ft., for the Burroughs Adding Machine Company, Second and Burroughs Avenue. The cost of the building is estimated at $750,000. A. Kahn and E. Wilby, Marquette Building, Detroit, are architects.

SAGINAW, MICH.—The Wolverine Tractor Company, Ford Building, Detroit, is contemplating the erection of a plant in Saginaw. New factory equipment, including a pneumatic riveting plant, lathes, milling machines, drill presses, etc., will be required.

COLLINWOOD, OHIO.—The New York Central Railroad Company is contemplating the purchase of two 10-ton and one 20-ton electric traveling crane and four locomotive cranes for its Collinwood shops.

SPRINGFIELD, OHIO.—Plans have been prepared by the Ohio Electric Company for the removal of its car barns, repair shops and storage house from Columbus to Springfield. Ground has been purchased for the new addition in West North Street and contract has been awarded for the construction of the storage house. Contracts for other buildings have not yet been awarded.

HAZARD, KY.—The Electrical Supply & Repair Company of Hazard is contemplating the construction of a machine and repair plant, to cost about $20,000.

LOUISVILLE, KY.—Bids, it is reported, will soon be asked by the Louisville Carriage & Taxicab Company, 421 Third Street, for the construction of a garage at Second

and Walnut Streets, to cost about $75,000. D. X. Murphy & Brother, Louisville Trust Building, are architects.

ANDERSON, IND.—The Hill Pump Company of Anderson has taken over the factory formerly owned by the Wagner Axle Company, which is being enlarged by a foundry, machine shop and boiler house. The foundry will be equipped with three traveling cranes and six jib cranes. The cost of the work is estimated at $100,000.

DANVILLE, IND.—The Public Service Commission has authorized the Merchants' Heat & Light Company of Indianapolis to issue $135,000 in bonds and $40,000 in capital stock for the purpose of taking over the property of the Danville (Ind.) Light, Heat & Power Company.

PERU, IND.—Additional locomotive shops, to cost about $1,000,000, will be erected at Peru by the Pennsylvania Railroad Company.

CHICAGO, ILL.—Plans have been filed by the Electric Steel Company, South Wood Street, for the erection of a new foundry at 1801-31 West Thirty-first Street, to cost about $100,000.

MANITOWOC, WIS.—Preparations are being made by the Board of Public Works for the installation of a 1500-kw. turbogenerator unit, with accessories, for the municipal electric-light plant, for which bids have been received.

MORRISVILLE, WIS.—The Board of Education has engaged Edward Tough, architect, 24 East Mifflin Street, Madison, to prepare plans for a three-room addition to the high school to be equipped for manual training work.

NEILSVILLE, MINN.—Bids will be received by T. A. Thompson, clerk, Nashville, until June 28 for electric-lighting fixtures and a 3-kw., 160-amp. lighting plant for the Neilsville school. William F. Kurke, 31 Huntington Block, Fargo, N. D., is architect.

ALLENDORF, IOWA.—Application has been made to the Board of Railroad Commissioners of the State of Iowa by the Allendorf (Iowa) Electric Company for a franchise to erect and operate an electric transmission line along certain roads and highways in Osceola County for the transmission of electricity for lamps and motors. Electricity for operating the system will be obtained from the transmission line owned by the Ocheyedan (Iowa) Electric Company.

SIOUX CITY, IOWA.—Bids will be received by Gardner & Lindberg, engineers, Chicago, Ill., for the construction of a meat packing house, including power house, for the Midland Packing Company, to cost about $750,000.

ADRIAN, MO.—At an election held recently the proposal to grant a franchise to Mr. Green to install and operate an electric lighting system in Adrian was carried.

ARCHIE, MO.—Contracts have been awarded by the Green Light & Power Company of Pleasant Hill for the erection of an electric transmission line to connect Archie and Pleasant Hill. The cost is estimated at $100,000.

KANSAS CITY, MO.—Contract has been awarded by the Kansas City Railways Company for the construction of a new substation, 43 ft. by 82 ft., to L. Breitag & Son Construction Company, at a cost of $25,000.

KANSAS CITY, MO.—The Jansen Ealsbery Laboratories is contemplating the construction of a factory building, 123 ft. by 60 ft., three stories high, for the manufacture of veterinary supplies, to cost without mechanical equipment about $60,000. The plans provide for electric-lighting installation and electric elevators. Ernest O. Brostrom, Reliance Building, Kansas City, is architect.

MARSHALL, MO.—Bonds to the amount of $80,000 have been voted for the construction of a municipal electric-light plant. Henrici & Lowry, Commerce Building, Kansas City, are engineers.

RICH HILL, MO.—Bonds to the amount of $14,000 have been voted for improvements to the municipal electric-light and power plant.

ST. LOUIS, MO.—The Union Electric Light & Power Company is planning to remodel its boiler house, at a cost of about $15,000.

BELVIDERE, NEB.—Bids will be received by the town of Belvidere until June 28 for construction of an electric distributing system, including three 10-kw., 13,000/2000-volt, three-phase, 60-cycle, step-down transformers, 80-kw. (total capacity) 2200/110/220-volt, single-phase, 60-cycle, pole-type transformers, all provided with oil hangers and blocks, one 5-kw. series transformer with panel and instruments for 6.6-amp., 110-volt, 60-cycle alternating-current house meters and five 10-amp. meters. The cost of the work is estimated at about $5,500. Charles F. Sturtevant, Holdredge, is engineer.

CLAY CENTER, KAN.—The municipal electric-light plant was recently damaged by the explosion of a flywheel, causing a loss of about $40,000.

JUNCTION CITY, KAN.—Bids are being taken (to close soon) by the Union Pacific Railway Company, Union Pacific Building, Omaha, Neb., for the construction of a 20-stall roundhouse, power house, storehouse, including electric wiring, steam piping, etc., in Junction City. R. L. Huntley, Union Pacific Building, Omaha, Neb., is chief engineer.

MANHATTAN, KAN.—The Manhattan City & Interurban Railway Company is contemplating the purchase of a second-hand 200-kw. rotary converter.

NEWTON, KAN.—Bids will be received by Adella Martin, city clerk, Newton, until July 3 for the construction of a sewage disposal plant, including two 300-gal. per minute motor-driven centrifugal pumps and pumping station. Black & Veatch, Interstate Building, Kansas City, Mo., are engineers.

Southern States

BRUNSWICK, GA.—The Butterworth-Judson Corporation, 61 Broadway, New York, N. Y., will install an electric-light and power plant to furnish electricity for lamps and motors to the proposed industrial city development, to cost $2,000,000, in connection with the $5,000,000 picric acid plant, which the company is building for the United States government in Brunswick.

JEFFERSONVILLE, GA.—Bonds recently voted for improvements to the municipal electric-light plant and water-works system have been sold, bringing a total of $15,500. Work will begin at once on the proposed improvements.

MACON, GA.—The Central of Georgia Railway Company has awarded contract to the General Railway Signal Company of Rochester, N. Y., for installation of an electric interlocking machine to operate electrical signals and switches on all tracks entering the Macon Terminal yards. The cost is estimated at $125,000.

MEMPHIS, TENN.—The Yazoo & Mississippi Valley Railroad Company is planning to install an automatic block system between Memphis and Coahoma, a distance of 65 miles, of which 20 miles is double track. The cost of the work is estimated at $135,000. A. H. Egan is general superintendent.

BIRMINGHAM, ALA.—The 90-mile transmission line of the Alabama Power Company from the power plant in Walker County to the government development work at Muscle Shoals has been completed. The company is now building a 30,000-kw. extension to its Warrior reserve steam plant, which is to be completed by Oct. 1.

WYLAM, ALA.—The sulphuric acid plant of the Steel Cities Chemical Company, it is reported, will be rebuilt by the construction department of the Virginia-Carolina Chemical Company of Richmond, Va. The plant, it is understood, will be enlarged and will cost from $150,000 to $200,000.

DREW, MISS.—Bonds to the amount of $15,000 have been issued for the installation of an electric-light plant.

GREGORY, ARK.—The Gregory Gin Company, recently organized, is reported to be in the market for power plant and cotton ginning machinery, to cost about $8,000.

GARBER, OKLA.—The installation of new equipment, to cost about $20,000, is reported to be under consideration by the Garber Light & Ice Company. William Musser is interested.

OKTAHA, OKLA.—The Oktaha Mill & Elevator Company is planning to install a new plant and equipment, to cost about $6,000.

WAURIKA, OKLA.—Arrangements are being made by the Consumers' Light & Power Company for the installation of new electrical machinery at its local plant. The proposed improvements will double the output of the power house.

GALVESTON, TEX.—The plant of the Brush Electric Company at Twenty-sixth and Post Office Streets was recently damaged by fire, causing a loss of about $75,000.

Pacific and Mountain States

AUBURN, WASH.—The City Council has granted the Valley Gas Company a franchise to install a distribution system and furnish electricity in Auburn. The franchise provides that the work must start before Jan. 1, 1919.

BELLINGHAM, WASH.—The Southwestern Engineering Corporation of Bellingham is contemplating the construction of a power plant in the Mount Baker district. The proposed plant will replace the present plant. The first unit will have a capacity of 75 hp.; the second unit of the same horsepower will be built in the fall.

SEATTLE, WASH.—Plans have been prepared for the erection of a three-story school building and garage 120 ft. by 250 ft. on Queen Anne Avenue for the Seattle Engineering School, Inc. Catalogs of steam, gas and electrical engineering equipment are desired. Sherwood D. Ford, Lyon Building, is architect. William T. A. Faulkner is president.

SPOKANE, WASH.—Preliminary plans for the buildings in connection with the proposed plant of the Washington Tire & Rubber Company, to be erected on Sprague Avenue, east of the city, have been completed. It is proposed soon to construct four buildings, including the main factory building, 300 ft. by 100 ft.; a service station, 50 ft. by 50 ft., and office building, 50 ft. by 60 ft. The power house will be attached to the main building.

SPOKANE, WASH.—The contract for complete electrical equipment of the Titan Feature Film Corporation plant and studio, located near Spokane, has been awarded to the Alexander Electric Company. The plans provide for a complete steam power installation, wiring a number of buildings of Titan City and also special lighting for the indoor stage. Exhaust steam from the generating plant will be used for heating the buildings. The plant will be capable of maintaining 6000 25-watt lamps. J. Don Alexander is president of the Alexander Electric Company.

TACOMA, WASH.—The City Council has passed an ordinance authorizing Hamilton F. Gronen, light and water commissioner, to contract for energy-consuming devices, such as electric heaters, ranges, water heaters, etc., amounting to $20,000.

FRESNO, CAL.—The Board of Trustees has adopted a resolution authorizing the installation of the electrolier lighting system in extension on Van Ness Avenue to the southern entrance of the city.

LOS ANGELES, CAL.—The installation of new ornamental standards on Broadway, between First and Tenth Streets, and California and First Streets, is under consideration by the City Council.

OAKLAND, CAL.—The construction of an electric railway by the Emergency Transportation Company to connect the plant of the Moore & Scott shipbuilding concern with the San Francisco-Oakland Terminals Railway on Eighth Street has been approved by the city of Oakland. The cost is estimated at $20,000.

SAN FRANCISCO, CAL.—Application has been filed by E. E. Lindsey of San Francisco for 30 cu. ft. per second of the waters of Buck's Creek, tributary to the North Fork of the Feather River in Plumas County. The proposed project will consist of a timber crib dam 20 ft. high, 75 ft. wide on the bottom and 25 ft. wide on the top, and a flume and ditch 4 miles long. The plans provide for a development of 4750 hp. under a 1400-ft. head, at a cost of about $153,000.

SONORA, CAL.—The Gold Ridge Mining Company is considering plans for equipping its mines for electrical operation.

SHELBY, MONT.—Contract has been awarded to the Two Miracles Concrete Company for lighting the town, to cost about $6,000.

CRIPPLE CREEK, COL.—Plans are being considered by the Golden Cycle Mining Company for the construction of a new electric power plant at Pikeview, near Colorado Springs, to cost about $200,000.

STERLING, COL.—The installation of new street lamps in Sterling is under consideration by the City Council. The Colorado Power Company is rebuilding its local lines and will furnish electricity to maintain the new lamps.

GREEN RIVER, WYO.—Bids are being asked by the Union Pacific Railway Company, Union Pacific Building, Omaha, for the construction of a 20-stall roundhouse, one-story machine shop, power house, storehouse, including electric wiring, plumbing, etc., at Green River, Wyo. R. L. Huntley, Union Pacific Building, Omaha, Neb., is chief engineer.

VALMORA, N. M.—Extensions and improvements are being made to the Valmora Sanatorium, involving an expenditure of about $100,000. The plans provide for the construction of a power plant and a large reservoir.

Canada

WINNIPEG, MAN.—Tenders will be received by the chairman of the Board of Control, Winnipeg, until June 27 for furnishing and erecting a 10,000,000-gal. motor-driven pumping unit, complete with switchboard, wiring, pipe connections, etc., for the McPhillips Street pumping station. Plans and forms of specifications, etc., may be obtained at the office of the city engineer, 223 James Avenue, Winnipeg.

TRURO, N. S.—Preparations are being made by the Town Council for the installation of an electric plant, to cost about $40,000.

HAMILTON, ONT.—Plans have been prepared by the Board of Control for the construction of a market house, including a refrigerating plant, to cost about $100,000.

OTTAWA, ONT.—Tenders will be received by John A. Pearson, architect, and J. O. Marchand, associate, Centre Block, Parliament Hill, Ottawa, until July 2 for lighting fixtures required in the construction of the Parliament Buildings. Plans and specifications and further information may be obtained at the office of P. Lyall & Sons Construction Company, Ltd., Ottawa, Ont.

REGINA, SASK.—A by-law providing an appropriation of $175,000 for a new electric generating unit and other improvements to the municipal electric-light plant has been passed. J. Russell Ellis is acting city engineer.

Miscellaneous

MAUI, HAWAII.—W. D. Stone, manager of the Hawaii Telephone Company, who has charge of the reorganization of the Maui Telephone Company, recently taken over by the Mutual Telephone Company, has recommended that in addition to an expenditure of $50,000 for the wire system, another $25,000 be expended in new buildings and equipment. A new central is to be established at Makawac, where a new building, to cost $3,000, will be erected for that purpose. A new exchange will also be erected in Hana, and the Paia and Lenaina centrals will be remodeled and put in a state of satisfactory repair.

Record of Electrical Patents

Notes on Recent United States Patents

1,266,702. Signal Apparatus for Automobiles; Berl W. Miller, Boise, Idaho. App. filed Aug. 14, 1916. Apparatus to be actuated by the operator for indicating the direction in which the vehicle is traveling.

1,266,711. Strain Insulator; Bentley A. Plimpton, Victor, N. Y. App. filed Jan. 25, 1917. Affords a cementless connection between a metal cap, stud or connecting member and the insulating portion of the usual type of strain insulating unit.

1,266,714. Telephone Metering System; Charles V. Richey, Washington, D. C. App. filed July 11, 1914. Eliminates mechanical complications and substitutes electrical and electromagnetic means.

1,266,777. Phonograph; Nelson C. Durand, Newark, N. J. App. filed Sept. 25, 1914. A telephone receiver in the telephone circuit is so mounted as to be capable of being positioned in operative relation to an ordinary phonograph recorder.

1,266,779. Electric Safety Lantern; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed Oct. 16, 1914. Construction to insure against the ignition of gases or other combustible materials.

1,266,780. Storage Battery; Thomas A. Edison, Llewellyn Park, West Orange, N. J. App. filed Jan. 20, 1917. Prevents batteries from becoming sluggish in action under certain conditions.

1,266,798. Commutator; William I. Hallock, Los Angeles, Cal. App. filed April 3, 1917. A timing apparatus for controlling the ignition spark of an internal-combustion engine.

1,266,801. Switch-Containing Plug Connector; George H. Hart, West Hartford, Conn. App. filed June 20, 1916. Connectors for connecting electric flatirons and other heating appliances in circuit.

1,266,811. Breaker Arm for Igniters; Joseph E. Johnson, Meriden, Conn. App. filed Jan. 20, 1917. Relates to igniters for internal-combustion engines.

1,266,814. Current-Supply Apparatus; Heinrich H. M. Kammerhoff, Orange, N. J. App. filed Dec. 13, 1912. A portable lighting apparatus for use in mines.

1,267,210. Electric Motor Construction; George Gillaspy, Joplin, Mo. App. filed March 17, 1915. Embodies a hollow casing constituting a handle and an electrically operated motor of improved construction snugly fitted within the handle.

1,267,400. Method of Treating Electrodes for Electric Welding; James H Gravell, Brooklyn, N. Y. App. filed Oct. 20, 1917. Consists in applying a thin coating of a metal with a low melting point to the bearing surface of the electrode.

1,267,436. Signaling Device; Louis W. Martin, New York, N. Y. App. filed March 14, 1917. Provides a simple, compact device which may be worn on the hand, arm or other portion of the body of the user, and through which ocular signals may be given by flashing lights.

1,267,463. Electrode for Electric Welding Machines; Gustave H. Schlommodau, Cincinnati, Ohio. App. filed Oct. 8, 1917. Consists of a compound electrode comprising essentially a steel center or core and a copper shell of good conducting material.

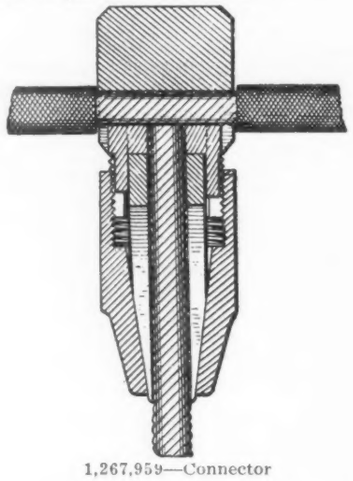
1,267,480. Electric Welding Apparatus; Edmund J. von Henke, Lynn, Mass. App. filed Oct. 8, 1917. An electric welding or riveting apparatus adapted for use upon plates.

1,267,481. Automatic Switching or Circuit-Breaking Device for Electric Welding or Other Metal-Working Apparatus; Edmund J. von Henke, Lynn, Mass. App. filed Oct. 8, 1917. Avoids the use of connecting wires between the welding or metal-working portion of the apparatus and the transformer itself.

1,267,491. Humidifier; Daniel H. Young and Charles H. Porter, Manchester, Iowa. App. filed April 16, 1917. Object is to supply regulatable evaporating means suitable for producing a constant supply of vapor to any inclosure.

1,267,613. Means for Holding Battery Elements; Frank E Whitney and Martin Melia, Philadelphia, Pa. App. filed July 27, 1916. Will automatically close up any spaces which may exist so that the separators, electrodes, etc., shall be maintained in the most intimate contact.

1,267,620. Dry Battery; Ferdinand P. Bauman, Kusnacht, Switzerland. App. filed Feb. 18, 1916. Relates to plate electrodes and carbon electrodes impregnated with impervious substances.



1,267,959—Connector

1,267,641. Resistance Body; Georg Egly, Berlin-Treptow, Germany. App. filed Feb. 21, 1914. Electrical resistance bodies which are made preferably from a material known under the name of "silit," consisting essentially of silicon and carbon.

1,267,642. Regulating Resistance; Georg Egly, Berlin-Treptow, Germany. App. filed Dec. 5, 1914. A regulating resistance having the shape of a segmental cogwheel in which the cogs carry the contacts.

1,267,653. Anode Connector; Julius H. Gillis, Toronto, Ontario, Canada. App. filed Oct. 15, 1917. Uses aluminum connectors in electrolytes.

1,267,671. Timer Distributer; George L. Lang, Newark, N. J. App. filed Oct 28, 1914. A timer for eliminating "back fires" on a reverse motion of the engine.

1,267,700. Radiator; Will R. Savage Omaha, Neb. App. filed Aug. 21, 1913. An electrically heated radiator.

1,267,706. Vacuum Regulation; Homer C. Snook and Edwin W. Kelly, Oak Park, Ill. App. filed June 11, 1915. Means for regulating the degree of vacuum of an X-ray tube or other vacuum tube.

1,267,726. Rheostat; Henry J. Wiegand, Milwaukee, Wis. App. filed March 8, 1915. Rheostats of the type known as field regulators.

1,267,727. Hoisting and Conveying Apparatus; Emery J. Wilson, Cleveland, Ohio. Applied to locomotive crane construction.

1,267,801. Process for Welding Tungsten Ingots; Carl A. Pfanstiehl, Waukegan, Ill. A process wherein fine particles of metallic tungsten are compressed in a suitable die or mold to form an ingot.

1,267,816. Interrupter Mechanism. John R. Stark, Racine, Wis. App. filed July 16, 1917. Devices for alternately making and breaking an electric circuit.

1,267,827. Electric Discharge Device; Willis R. Whitney, Niskayuna, N. Y. App. filed Nov. 6, 1914. Devices to suppress local disintegration or erosion of the cathode.

1,267,846. Battery Grid; Clarence H. Cable, Topeka, Kan. App. filed June 25, 1917. Provides an adequate support for the active materials.

1,267,858. Inclosed-Arc Device; Charles V. Ferguson, Schenectady, N. Y. App. filed July 3, 1916. Devices in which an arc is operated between an incandescent cathode and an anode.

1,267,879. Rheostat; Nils D. Levin, Columbus, Ohio. App. filed Aug. 17, 1915. Provides a resistance device which will have all of its parts compactly arranged.

1,267,888. Incandescent Cathode Device; George S. Meikle, Schenectady, N. Y. App. filed Aug. 15, 1916. A refractory cathode adapted to operate at incandescence in a gaseous medium.

1,267,919. Controller; Karl A. Simon and Arthur J. Hall, Wilkinsburg, Pa. App. filed April 4, 1914. Controllers for governing the operation of dynamo-electric machines.

1,267,930. Electric Locomotive; Norman W. Storer, Pittsburgh, Pa. App. filed Nov. 5, 1915. Relates to the arrangement of the trucks embodying the running gears of electric locomotives.

1,267,959. Connector; Robert A. Becker, Poughkeepsie, N. Y. App. filed Nov. 27, 1916. The end of the tap or branch line is securely held in firm, binding relation with the main cable.

1,267,973. Electric Resistance Device; Lewis W. Chubb, Edgewood Park, Pa. App. filed Jan. 6, 1915. Provides a resistance device with effective and rapidly operating cooling means.

1,267,976. Method and Apparatus for the Electrical Reduction of Ores; Bayard G. Cobb, Dawson City, Yukon, Canada. App. filed May 23, 1913. A method of balancing or controlling the arc.

1,267,978. Electrical Resistance; John Collinson, Manchester, England. App. filed March 4, 1915. The grids are made of sheet metal which may be either punched, "expanded" or otherwise treated to afford a lengthened path for the current.

1,267,984. Igniter; Frederic H. Davenport and Howard H. Manning, Meadville, Pa. App. filed June 22, 1914. An igniter with an automatic means for advancing the spark, with devices for controlling the maximum of the advance.

1,267,991. Ignition Device; Arthur Dickerson, Salt Lake City, Utah. App. filed June 28, 1916. Ignition devices for internal and combustion engines.

1,268 018. Carbon Brush Holder; J. H. Knight, Fort Worth, Tex. App. filed March 6, 1917. A resilient means for automatically adjusting the carbon brushes.

1,268 031. Moldable Material; James A. McCoy, Wilkinsburg, Pa. App. filed March 30, 1915. Process of making molded articles that comprises mixing an inert filler with a vegetable oil.